JOURNAL OF GAS LIGHTING AND WATER SUPPLY

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VOL. CXXXVI. No. 2796.] LONDON, DECEMBER 12, 1916. [68TH YEAR. PRICE 6d.

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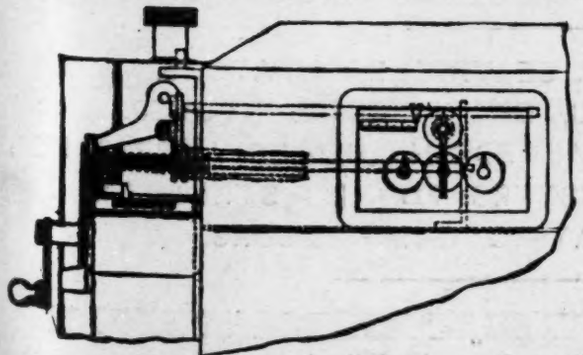

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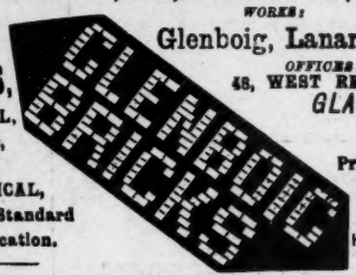

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JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXXVI., No. 2796.] TUESDAY, DECEMBER 12, 1916. [68TH YEAR.

EDITORIAL NOTES.

Calorific Applications and Inquiries.

WHEN the Gas (Standard of Calorific Power) Act was passed, it was intimated that the process of making application to the Board of Trade or the Local Government Board, as the case might be, was to be a very simple one. It could be by letter; merely plain newspaper notices, and notices to local authorities were required; and a modest amount of information was needed by the Board of Trade or the Local Government Board. So simple were the conditions that there would be no need of Parliamentary Agents, Counsel, or expert witnesses. Gas undertakings were to be allowed the unusual felicity of obtaining something of value from Parliament direct without the intervention of middlemen. But the best-laid schemes of Parliament and Government Departments "gang aft agley." This one did. Local authorities, suffering from the most mistaken notions as to what was going to occur, commenced to turn all the contemplated simplicity and ease into something complicated and very serious by retaining all the forces—Parliamentary Agents, Counsel, and witnesses—necessary for a forceful attack at the inquiries into their objections. This was not what was anticipated. But it is what happened in both the Cheltenham and the Sheffield cases; and other companies began to hold back, and fear that they might be put to similar expense and trouble. The Board of Trade, however, were not minded that this sort of thing should continue, and that fight should succeed fight over the same questions and on the same grounds. When the Sheffield Order was issued, it was intimated in the "JOURNAL" that what had been decided in this instance constituted the lines that would be followed, unless very exceptional circumstances were submitted to the Board, which, in their opinion, warranted the holding of an inquiry. We cannot conceive that any very exceptional circumstances are likely to arise that have not already been fully investigated. However, the National Gas Council have been making inquiries into the matter, with the result, as the Secretary (Mr. W. J. Smith) informs us in a communication published elsewhere in this issue, that the Council have ascertained that, except where there are special circumstances, the Board of Trade are not likely to hold inquiries into applications, although there may be objections lodged against them. Therefore it may be finally accepted that the fear of heavy expense in attending, and being professionally represented at, an inquiry need not deter any undertaking from making application for an Order. It is useful to have this further assurance, as it is a pity that undertakings large and small, or of any intervening size, should not, if practising the oil-washing of gas for the extraction of benzol and toluol, take advantage of this opportunity to cut themselves adrift from the moribund illuminating power standard, and bring themselves under the only standard for gas that is a rational one, and is so because it is the only one that fits the circumstances of the current treatment and uses of gas.

Home Food Production and Sulphate of Ammonia.

THE men of the gas industry will watch with more than the interest of the ordinary patriot the steps the Government propose to take with the view of stimulating the production at home of foodstuffs; for there is no question about it that this is one of the most vital of the urgent problems of the moment, and one in which intensive cultivation and sulphate of ammonia have an inherent part. Had the propaganda work of the Sulphate of Ammonia Committee among the British farmers met with its rightful deserts, the foodstuff problem of to-day would have been a much easier one to face; and the country would have found itself in a stronger and more stable position to meet present food requirements, while knowledge gathered from experience by the farmers would have been highly valuable in now increasing cultivation, given the requisite supply of labour. There are some British farmers who have made good use of their opportunities and of scientific farming. There are others who have been pursuing a policy of drift; and they at all events have proved to be unreceptive soil in respect of the seed scattered by the producers of sulphate of ammonia, whose work has never been supplemented (as Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Association, has said) by the interest of the Government, whose sensible horizon of national affairs never comprehended agriculture in relation to war, to shortage of shipping, and to an ever-growing curtailment of tonnage from submarine activity. What was not contemplated has come to pass; and the movement of the Government—nearly two-and-a-half years after the war started—to ascertain what can now be done to increase our home supplies, and so secure the country, is the best condemnation of a past supineness in legislating with the view of making the country as self-productive as possible in meeting its own needs.

The awakening has not come too soon. The last-issued official returns show that there has been an actual decline in the average quantity of wheat produced per acre compared with the past ten years' average, and that the average yield of wheat itself has also diminished—thus proving a deterioration of quality. The Government are proposing (in order to increase the foodstuff production) to enter upon land now unoccupied, upon other lands with the consent of the occupiers, and to make use of selected portions of common lands. But we have seen no indication that they have considered taking steps to ensure that the utmost is made of the land now under cultivation by the application to it of scientific fertilizing. In the discussion that has been proceeding in "The Times" between Professor Somerville and Mr. Milne Watson, the former advocated that the use of sulphate of ammonia should be made compulsory. Britishers hate compulsion in anything; but they have sometimes to swallow their dislikes in the interests of the country. In this instance, compulsion ought not to be necessary, when such figures can be shown as Mr. John West gave readers in our "Correspondence" columns of last week's issue as to the wealth of result per acre that has followed, in the case of his own son's farm, from the scientific use of sulphate of ammonia. But it is passing strange that even facts such as these, which represent a considerably enhanced hard cash profit per acre of land under cultivation, do not have much effect in stirring-up within many other British farmers a desire to profit in like manner. That is the difficulty. It is the difficulty that has to be overcome; but whether temporary compulsion is the correct way of doing it, we are somewhat doubtful.

However, on all hands, the Government are being pressed to put into this question of the greater home-production of foodstuffs the energy that the exigency of the time and supplies demands. Various influential bodies are urging them to lose no time in taking land, in facilitating the output of agricultural machinery and the application of fertilizers, and in securing the necessary labour. The Royal Horticultural Society have urged the need of proper organization, in order to secure right cultivation and fertilizing for the production of maximum crops. In all this, the gas industry must again take a prominent place. It, with the other coal-carbonizing industries, came to the relief of the country in its extremity for high explosives; and now it must, if the present movement is to realize a really successful issue, again take a prominent place, assuming the Government proposals are to be developed, in providing for the land the necessary stimulant to induce an abundant harvest. But there must be no more export prohibition of sulphate of ammonia, for the reasons that it is unlikely that even necessity for extended home food production would mean total absorption of make, and that our requirements from abroad demand

the application of some of our sulphate of ammonia in other parts of the world. Supplementing this, for financial reasons, the Board of Trade are anxious to see the export of home productions lessened as little as possible. Sulphate of ammonia manufacturers will do, as they must do, all they patriotically can under fair business conditions. But they must not again be subject to the injustice which they suffered at the beginning of this year, and which resulted in for a time the crippling of their sulphate business, in financial loss, and in the accumulation of stocks. And all for the benefit of British farmers, which benefit they themselves rejected by their irresponsiveness. Meantime, the importation of nitrate of soda has diminished; and this year it will represent a comparatively few thousand tons. In view of all the circumstances, the Government proposals as to the increase of home-grown foodstuffs should redound to that development of the home trade in sulphate of ammonia which has been so long and so actively sought for by producers. The hope that this will be so is stimulated by the appointment in the new Government of Mr. R. E. Prothero as President of the Board of Agriculture—he having given great attention to the study of scientific farming.

Government Control of Coal and Shipping.

The action of the Government in taking over the control of the South Wales coalfields is only, it seems, the prelude to bringing under the same domination the whole of the coalfields of the British Isles. It was probably not the intention of the late Government to go so far as this. But the Parliamentary Labour Party have large ideas as to the value of their support; and the new Prime Minister (Mr. Lloyd George) is wise enough to know the direction of those ideas, which in some respects fall in with his own views as to what the country requires in order to prosecute the war with the minimum amount of harm to national interests. He therefore affably promised the Labour Party that the State would take over the coal mining and shipping industries for the period of the war, which means the whole and not merely part. In some respects, we think—especially in connection with the Coal and Coke Supplies Committee—the Board of Trade have hitherto been governed in their decisions and actions too much by interested parties; and certainly the inaction of the Board and the Government in the matter of shipping has been one of the mysteries of the war, and will ever remain so. The past policy has been the means of raising unduly the prices of imported food and home-produced coal to the public. The Price of Coal (Limitation) Act has only been partially effective; and the Board, by their dicta as to the meanings and limitations of the provisions of the Act, themselves provided a bridge over which the coal proprietors could (or rather those who desired to do so) pass in order to evade the Act. There has been a lot of bungling; and this is clearly within the knowledge of the keen-sighted Prime Minister who has undertaken the ponderous task of trying to reverse the desultory policy of the past. Much precious time, however, has been lost; much mischief has been wrought. There would not have been half the worry there has been over coal and shipping if, soon after the war started, there had been regulation. We are now suffering from the want of foresight then; and it is a question whether the day has not passed when much improvement can be effected, sharp-witted Government control notwithstanding. However, if what Mr. Lloyd George promised comes to pass, the position at any rate cannot be worse than it is now, and there will certainly be the satisfaction of knowing where we are.

Generally speaking, the declaration of the new Prime Minister on these two points produced a good effect in the country, but not upon the owners of coal mines and ships. They are waiting for further intelligence as to the development of the promise. When this intelligence is in their possession, there may be, as there has been in the case of the South Wales collieries, a general depreciation of the current high market values of colliery and shipping shares, which values have been inflated by the character of the war-time dividends. It is reported that, in a very few days, the South Wales coal shares, on the announcement of Government control, shed in the aggregate something like £800,000 of their gilt. As we said last week, this sort of thing tells its own tale—a tale that points to a preference in war time for unlimited dividend powers as opposed to controlled profits. Of course, shipowners profess to think that the Government control will be disastrous; the coalowners think the same. Nothing could be more natural. One shipowner says that the costs of insurance and labour are now so heavy that high rates of freight are inevitable. It just happens that there is no need to rely on the *ipse dixit* of a shipowner in this respect. Including all charges, gas companies are running their own boats between the Tyne and London at about one-fourth of the market rate; and this is a fact that refuses to be dismissed by mere words. Perhaps, however, the shipowners will take heart from the fact that the Shipping Controller in the new Government is Sir Joseph Maclay, a leading Glasgow shipowner. But the promise of the Prime Minister to Labour remains, and the market prices of shipping shares are falling.

For a moment turning to the South Wales coalfield, it is thought that the Government have been too easy in their concession conditionally of the 15 per cent. increase of wages to the miners. If the result of the audit of the colliery books shows that it is not justified, it will not be a simple matter, having once conceded it, for the Government to relieve the miners of it. The owners are annoyed with the Government for giving way to the men in this matter before knowing whether or not there was good ground for their action; and they reproach the Government for being parties to a breach by the workmen of the Conciliation Board agreement, the terms of which were only settled by the Government themselves last year.

Weathering of Gas Coal.

Perhaps the most systematic attempt that has yet been made to ascertain the depreciating effect upon coal of long storage and exposure is that which has been made by Professor A. H. White over a course of five years, the results of which have been incorporated in a communication to the Michigan Gas Association. The value, however, of a test of this kind is limited by the physical characteristics of the coal, by its environment during storage, climatic conditions, and other factors; and so limited, Professor White's results can only be considered to apply to the particular coals experimented upon, or similarly physically constituted ones, and stored under identical conditions, local and atmospheric. Moreover, no great reliance can be placed upon the results produced by the carbonization of the two coals at different periods after having been stored, seeing that they obviously show variations in the retort temperatures, and in the duration of carbonization; and, moreover, some of the tests were made in fireclay retorts, and others in new silica ones. But taking the showings of the chemical analyses at the different periods of the five years, it is seen (especially from the analyses in which the moisture and ash were eliminated), how in the case of these two coals, there was, right up to the end of the five years, very little change which would influence their gas-making value. Hence the practical deduction that "gas coals of this type can be exposed to the weather, in a rather severe climate, for five years (provided they do not heat in storage), and at the end of the five years will be entirely satisfactory gas coals." Assuming that this finding would apply to all coals (which it would not do, owing to variations in physical structure and constitution, differences in permeability and absorption, differences in size so providing more or less surface for atmospheric influence, and so forth), it would remove one anxiety from the already loaded mind of the gas engineer, who does not find it an economical thing to have to pay for the removal of coal from store, and then replace it again in days not only of war, but of labour arbitrariness, and the alliance of trade unions for enforcing obedience to their wishes, which conditions compel, as a protection against the stoppage of deliveries, the carrying of large stocks of coal involving much idle capital. If, as we say, the results in Professor White's paper were proved to be universally applicable, there would be some consolation to gas suppliers in the assurance that the interest on the additional capital, and the costs of storing, involved by the larger stocks, were the only losses occasioned by the new order of things.

The method of the trial was quite satisfactory as regards the taking of the coal and the three modes of storage—in bins, submerged in water, and packed in large cans with perforated bottoms and tops closed with a coarse screen. As to storage by submersion in water, this, with the coals under trial, would be a superfluity, judging from the insignificant advantage over bin storage as shown by the chemical tests. As to the can storage, it seems to us that, though

the cans were partially buried in the bin coal, they, having perforated bottoms and a coarse screen at the top, would in effect act as shafts, and keep a current of air passing through the coal which might detrimentally, although infinitesimally, affect it, judged either by weight or chemically. As it happens, this is not shown by the coals under test, though there are negligible variations. The laboratory equipment employed in the tests is quite beyond reproach; but the carbonizing trials are the weakest part of all. These were based on 2000-lb. samples. And the coal that had been in store the longest—this applies to both classes of coal—shows the largest make of quite a respectable candle-power gas, and with a total heating value per pound of coal carbonized exceeding any one of the shorter storage period tests; but the five-year tests are those made in silica retorts. There is, however, no really safe standard with which to compare; inasmuch as the figures for the coal that was carbonized as early as convenient after being mined have no reliability through temperature and carbonizing duration defects. Readers are asked to dismiss the ammonia results. This is wise, as the figures would have been open to some criticism with from about 1·5 to 1·7 per cent. of nitrogen in the coal. The unreliability of the carbonizing figures will result in more interest being taken in the chemical investigation. We should imagine that the coal stored was large and of solid physical structure for it to have disclosed such splendid consistency in the analytical results at equal intervals over such a period as five years. Coal taken from the bins at a depth of 7 feet at different periods show that the percentage of depreciation in heating value is slight, and that in respect of volatile matter, fixed carbon, sulphur, or nitrogen, the variations are negligible. The same applies to the upper 6 inches of the coal stored in the bins. There was very little variation shown in the chemical composition and the heating value of this top layer of coal, although a greater change might have been expected in view of the larger exposure and the increase in the proportion of fine coal due to the weathering.

However, there are the results. So far as the chemical ones are concerned, they may be accepted as absolutely correct—that is to say, within the small limits of analytical error—for all the chemical work that is carried out at the experimental station of the Michigan Gas Association, or in the Chemical and Engineering Department at the Michigan University, has the guarantee upon it of Professor White's personal supervision. We should like to see a similar series of tests carried through (say) by the Fuel Department at the Leeds University, or at the Doncaster Coal Owners' Laboratories, with different British gas-making coals. At the Doncaster Laboratories, it will be remembered there has been some excellent experimental work relating to various problems bearing upon the spontaneous combustion of coal.

Vaporizing Oil for Naphthalene Prevention.

In connection with the oil or tar washing of gas and its accompanying naphthalene nuisance, some gas engineers prefer, for avoiding the latter, the spraying into the gas of petroleum in the form of a mist, while others favour the vaporizing of the petroleum. At the meeting of the Southern District Association a few weeks since, Mr. Doig Gibb expressed himself as having a preference for the spraying process; and Mr. Whitehead, of the Explosives Supplies Department, stated that the trouble has "so far best been "treated by paraffin oil spraying." On the other hand, Mr. Thomas Glover inclines to favour vaporizing. A good testimonial to treating washed gas by petroleum vaporizing (using the vaporizer invented by Mr. Glover) was given by Mr. E. P. Vince, of Minehead, at the last meeting of the South-West Association of Gas Engineers. There was considerable naphthalene trouble at Minehead upon the introduction of tar-washing; and various simply applied expedients were tried for dealing with the difficulty. Eventually Mr. Vince decided to adopt the Glover vaporizer; and now trouble is very rare.

One preliminary incident in the experience serves to emphasize two points. The first is that the treatment of the gas for the prevention of naphthalene troubles should begin simultaneously with the application of oil or tar washing; but if the distribution system is allowed to get into a naphthalene-fouled state, then it must not be expected that the setting to work of a petroleum spraying or vaporizing apparatus is going to give any immediate relief. It takes some time. When the vaporizer was first put to work at Minehead, the trouble was actually accentuated instead of lessened; but it seemed to be retiring to the outlying districts, and it gradually disappeared, which pointed to the clearance of the distribution system. Now the vaporizer is only used once a fortnight; and all is well.

There is another point about this Minehead experience which is of interest, as showing the small expense of the system of cure and prevention in relation to the amount of expense, worry, and vexation caused by naphthalene deposits and stoppages—in fact, it is down to about one-half the expenditure of paraffin oil that Mr. Glover spoke of as being essential when the vaporizer first made its appearance. Mr. Vince finds that an oil consumption averaging 3 gallons per week is sufficient now that the mains are all clear; whereas—bearing in mind that the quantity of petroleum required will vary to some extent with local circumstances—it was originally suggested that 25 gallons would deal with about a million cubic feet of gas, and that, after the first month or two, half this quantity would suffice. Mr. Vince sends out an average of about 500,000 cubic feet per week; so that his consumption, now that the mains are clear, is about 6 gallons per million. To get clear mains, better pressures, and freedom from complaints due to naphthalene, at such a low cost as the working of the process at Minehead represents, are conditions that no gas manager in his right senses would deny himself.

Municipal Gas Profits and Income-Tax.

Once more the question of the relationship which it is both proper, from a sound commercial standpoint, and expedient should be maintained between municipal trading undertakings and the general rates, has been discussed by the Stockport Town Council; though the precise point over which it arose on the present occasion was the heavy rate of income-tax to which profits made are now liable. The proposition was that a Special Committee should be appointed to review the basis upon which the trading Committees have hitherto made annual contributions out of their profits in aid of the rates; and the introducer of it disclaimed any wish to prejudge the matter, which he put clearly in saying that it should be considered whether the commercial undertakings should be run with the idea of relieving the rates or of supplying the commodities required. The enormous sums which have in past years been taken from municipal trading undertakings throughout the country for the benefit of the general rates have in different ways worked great injustice to gas consumers, out of whose pockets these profits have come; but, as was admitted, in the case of Stockport, the basis on which they have been working has been that of expediency. Now, however, a condition of affairs has come about in which it may not even be expedient to make these large profits out of one section of the ratepayers and divide them among all; for in the process a very large proportion of the amount will be diverted to the coffers of the Inland Revenue Commissioners, and thus, except indirectly, be lost to the town. One member, by way of settling the question, ventured to express the hope that the Local Government Board would refuse to sanction further loans unless only a fixed proportion of any surplus was used for relieving the rates, and the balance for wiping-off outstanding loans, the cost of new machinery and extensions, and so forth. Against this, of course, there was the plea for keeping the rates down, so that large industrial concerns may be induced to come to the town. But a stronger argument—assuming the prevailing system to be the correct one—was that it would be unfair for the Corporation to attempt an evasion of the payment of income-tax. No doubt the Special Committee, had they been appointed, would have presented a useful report; but the majority of the Council were of the opinion that they have no use for such a report.

Absenteeism at the Coal Mines.

The Miners' Federation have found a way of dealing with the question of avoidable absenteeism which, it is hoped, will prove effective. The subject is an important one for the country; for it has been authoritatively shown before that, if avoidable absenteeism could be eliminated from the obstacles to maximum output, the deficiency of coal ontput which is said to exist now would also be made good. The suggested *modus operandi* in securing full attendance at work otherwise than when prevented from unavoidable

cause is the infliction of fines by local joint committees, whose proceedings in the matter of fines are to be governed by rules to be framed by the Federation. Fines or penalties applicable to the men, it is further proposed, shall be applicable to officials who are proved to be in fault. A miner who avoidably absents himself can elect to be fined by the local committee or by a magistrate. There is not much question as to the direction in which his preference will incline; for a magistrate is not likely to look with any lenient eye upon avoidable absenteeism on the part of a miner at such a time as this—avoidable absenteeism that is a crime to-day. Another reason why most men will prefer to be dealt with by a joint colliery committee is that it is intended that he shall have the opportunity to redeem the fine by working full time for a month; while any fines not so redeemed are to be paid over to a charitable institution. Of course, the amount of the fine will be a factor in beneficial effect.

Nitre Cake for Sulphate Making.

One of the features of Mr. R. J. Gavin's paper before the Scottish Junior Gas Association (Eastern District) last Saturday was his reference to a test in the use of nitre cake in sulphate of ammonia making at the Galashiels Gas-Works. The substitution of nitre cake for a part of the sulphuric acid required in the manufacture is not regarded with any particularly friendly feelings by gas engineers, who are averse (with an eye on the future) to damaging their sulphate of ammonia reputation. Mr. Gavin's test was not conducted quite on the lines recommended by the Sulphate of Ammonia Association. He employed a simple arrangement for dissolving the nitre cake by steaming; and the cake dissolved quite easily—giving a solution testing 93° Twaddel at 60° Fahr. In their published Memorandum, the Association have recommended that the nitre cake should be dissolved in water till the solution showed 100° Twaddel at 200° Fahr. In the test, 84 lbs. of nitre cake solution was used to 112 lbs. of sulphuric acid; the bath standing at 58° Twaddel, but this was worked down to 56° Twaddel. The Association suggested the use of a quantity of nitre cake not exceeding 10 per cent. by weight of the acid. The best working strength, they also said, was 80° to 84° Twaddel; and one volume of the nitre cake solution of this strength should be used with every ten volumes of 70 per cent. chamber acid, or its equivalent. The salt then produced would vary from 23 to 24 per cent. ammonia. However, under the conditions of his test, Mr. Gavin arrived at practically the same result: A 23·59 per cent. ammonia salt, with a 0·78 per cent. free acid and about 3 per cent. moisture content. As he says, though the ammonia content in this salt is rather lower than the Galashiels standard of 24·5 per cent. (the drying arrangements there are opposed to always working to a 25 per cent. standard), "it might do" as a commercial article in these times when sulphuric acid is so scarce.

The Annual Rating Statistics.

In various respects, the newly issued statement of Mr. W. Allison Davies (the Borough Treasurer of Preston) in regard to the rates levied in various towns, and charges which have a bearing on the matter, reflects the influences of the war, though as these influences must be of a fairly general character, the comparisons have probably not been greatly vitiated by them. It may quite safely be assumed that for years to come Imperial taxation must be of such a nature as to render even more tempting than before, both as residential and as business areas, those districts which have the good fortune to enjoy specially low rates, combined with a full and cheap gas and water supply; and the statistics for 1916-17 show that economies have clearly been practised in many directions. With practically the same list of towns included, there are on the present occasion only 32 in which the rates amount to 9s. or more in the pound, as compared with 42 a year ago. In eight instances the rates are over 10s. in the pound (the figure was a dozen twelve months ago), and in Merthyr Tydfil and Norwich they are 11s. or more. Going to the other end of the scale, there are three towns—Blackpool, Bournemouth, and Oxford—in which the rates are 5s. or less in the pound. The table showing the prices charged for gas, water and electricity, a year ago revealed a perfectly natural movement in the direction of higher charges. Two years back, in 28 of the places included, the charge for a supply of gas for domestic lighting was 2s. or less per 1000 cubic feet. In last year's compilation this number had been reduced to seven, and at that it still stands in the issue now before us. Judging from this 2s. figure, it appears that the consumers of gas have during the past twelve months—in a period of rapidly rising prices all round—had good reason to be satisfied. The table showing the extent to which rates have been relieved in various towns owing to receipts from municipal trading undertakings, contains the names of only five places where the amount reaches 1s. in the pound. This, again, is four less than a year ago, but only about one-half what it was twelve months before that. There were nine instances in which deficiencies on municipal undertakings entailed an increase of 1s. or more in the pound to the rates, and several others which came near to it. The great bulk of the deficiencies incurred are always on account of water supply, with still a fair number of electric light deficits, and still more on account of tramways.

CALORIFIC APPLICATIONS AND INQUIRIES.

Acting on the instructions of the National Gas Council, the Secretary (Mr. W. J. Smith) has forwarded for publication the following information on the subject of calorific standard applications and inquiries.

In reference to the suggestion recently made that the various applications to the Board of Trade for an Order, under the Gas (Standard of Calorific Power) Act, 1916, to substitute a calorific power standard of 500 B.Th.U. (minimum) for the existing illuminating power standard, might be jointly promoted, it has been ascertained that, except where there are special circumstances, the Board of Trade are not likely to hold inquiries upon such applications, though there may be objections lodged against them.

The fear of heavy expense in attending and being professionally represented at inquiries need not, therefore, deter any undertaking from making application for such an Order.

The Sheffield Order may fairly be taken to indicate the lines which the Board will follow in other cases.

PERSONAL.

Mr. E. J. Hutchence, whose appointment is announced as a Senior Assistant Engineer to the Gas Light and Coke Company, was formerly Manager of the Hanover works of the Imperial Continental Gas Association, under Mr. William Anderson, the Engineer. On the outbreak of the war, Mr. Hutchence returned to England, and has since been engaged at the Beckton Gas-Works.

Readers will note in the official list of members of the new Government that Dr. C. Addison is to be Minister of Munitions. In his former position as Parliamentary Secretary at the Ministry of Munitions, it fell to him to reply to many questions in the House, of which he has been a member for only about six years. Sir Alfred Mond, who becomes First Commissioner of Works, is Managing-Director of Messrs. Brunner, Mond, and Co., a Director of the South Staffordshire Mond Gas Company, and Chairman of the Power Gas Corporation.

Mr. Edward Alex. Buckley, assistant at the Farnham Gas-Works, has been appointed to succeed his uncle as Engineer, Manager, and Secretary to the Holmfirth (Yorks.) Gas Company. The successful candidate for the vacancy caused by Mr. A. E. Buckley being appointed as Chief Engineer of the Malta and Mediterranean Gas Company, was trained under his father at the Formby Gas-Works, and afterwards passed through the various shops and the drawing office of Messrs. R. Dempster and Sons, Limited, of Elland. For the past two years, he has been assistant to Mr. A. E. Saville at Farnham.

The Directors of the Ryde Gaslight Company have appointed Mr. Walter Parker, the Superintendent of the Lum Street Gas-Works, Bolton, as their Engineer and Manager, in succession to the late Mr. Farrand. Mr. Parker served his articles under Mr. W. J. Smith, B.Sc., at Carlisle, and was afterwards placed on the staff as Assistant Engineer and Manager. He occupied the position for some five years—vacating it early in 1910, on obtaining the appointment of Chemist and Assistant to the Bolton Corporation. About eighteen months later he was placed in charge of the Gas Street works; and so impressed was the Engineer with the enhanced financial results obtained, and the tactful manner with which the men were handled, that he promoted him to the larger station at Lum Street, where again the results of good management have been manifest. During Mr. Parker's service at Bolton, both stations have been modernized—well over £100,000 having been spent on alterations and renewals. The remodelled works in each case have been placed under his direct supervision, to inaugurate the new plant and to organize the system of working conditions. As Chief Assistant, he has for the past five years taken entire charge during the absence of the Engineer and Manager. Mr. Parker commences his duties at Ryde early in January.

CAPTAIN S. P. THORNTON.

THE extreme sacrifice has been made by yet another well-known member of the gas industry—Captain S. P. Thornton, of the Leicestershire Regiment, who is reported killed in action. The loss is one that will be keenly felt by many business and personal friends throughout the country, and particularly in the Midlands, where he was well known. Son of the late Councillor J. M. Thornton, who took a leading part in the muncipal life of Leicester, Captain Thornton was educated at Mill Hill School, Leicester, and at Wellingborough. The whole of his home life was spent in his native town, except when business claimed his attention in other parts of the country. From his youth he was keenly enthusiastic in sport.

Prior to taking up his commission in the Leicestershire Regiment, Captain Thornton was for twenty-one years with the Richmond Gas Stove and Meter Company, Limited. For some years he had charge of the Plymouth branch of the Company, with control of the Western and South-Western Counties; and subsequently he was appointed chief representative of the important area of the Midlands and South Wales. When, in 1914, he placed his services at the disposal of his country, he was actually over the limits of military age, but was very conscious of the stern patriotic duty that claimed his services.

Three weeks or so ago, he was home on leave; and the many friends who greeted him recall the cheerful bearing of a man who served his country without thought of self. At the time of his death, Captain Thornton was Worshipful Master of the Murdoch Masonic Lodge, of which he was one of the founders. His installation to the chair took place in March last—one week prior to his leaving for the front.

We learn that he was in the front line trenches in France last week, and that a fragment of a burst shell entered his side and penetrated a lung. Everything possible was done by the medical service, and an operation was performed; but he died within a comparatively few hours.

The following extract is from a letter to his brother, Mr. H. M. Thornton, J.P., the Managing-Director of the Richmond Gas Stove and Meter Company, from one of his numerous friends:

> The writer would like to put in a word of a personal note—being a Leicester man and one who has watched with interest the work of the "Tigers." An old Leicester friend of mine (since killed), who had the honour of being in your brother's battalion, spoke of him as "one of the very best and jolliest of officers and a gentleman who took such great interest in the men's welfare—a sport." This, I thought, spoke volumes from a private. He has fought a good fight and made the greatest sacrifice, for us all—a glorious death.

AN APPRECIATION BY MR. SIDNEY O. STEPHENSON, ACTING MASTER OF THE MURDOCH LODGE.

Although it was an event that, in the circumstances, one had unfortunately to be prepared for, the sad loss of Captain S. P. Thornton has come as a distinct shock to the very many friends whom he possessed in the gas industry, particularly in the Birmingham and Midlands district.

He was the life and soul of any company in which he happened to be, with his unfailing good humour, ready wit, and inexhaustable fund of amusing anecdotes. He had also a brilliancy of repartee rarely equalled, and was invariably the victor when anyone had the temerity to challenge him, to the great amusement of those who were present to listen to the passage of wits.

He was one of those gentlemen of commerce (a phrase coined by himself on one of those occasions when he was giving his wits full play) who had the rare and happy gift of making his business calls appear to be in the nature of a visit of an old and intimate friend whom one was pleased to entertain, rather than a visit in pursuit of business.

He was a true Englishman, and one of whom his countrymen have good cause to be proud, for he not only placed his services at the disposal of his country in the early days of the war, but being over military age was a volunteer in every sense of the word.

It has become a saying that things will never again be as they were; and the loss of our old friend is a confirmation of it, for the circles in which he used to move will never be quite the same as in the old days when he used to come among us.

He was one of the three who joined with me in the inception of the "Murdoch Lodge" at Birmingham. Two, alas! have joined the Grand Lodge above, for Worshipful Bro. Chas. Meiklejohn, the first W.M., and now Captain S. P. Thornton, are no more. It was my great privilege and pleasure to instal him as Master of the "Murdoch" in March last. He was very proud to occupy the chair, and his election to it was exceedingly popular. I have rarely seen him in such high spirits and good form as on that occasion; and the evening was a most successful and joyful one, surrounded as he was by many of his most valued friends.

He has given his life for his country—the greatest and noblest sacrifice that any man can make. Long may his memory be cherished.

AN APPRECIATION FROM A COLLEAGUE AND A "BRO. W.M."

By J. FRED. WICKS.

It is with a very sorrowful feeling I write an appreciation of the late Captain Thornton, who was one of my colleagues for upwards of fifteen years. I can, therefore, claim to know something of his disposition and good qualities. Captain Thornton was the pivot of joyfulness, good nature, and goodwill; ever ready and willing to support charitable or social causes; and one who had a decided tendency not to forget those in more humble circumstances of life. He voluntarily gave up his lucrative appointment, happy home, wife, mother, and friends, and at last his life (what a sacrifice!) to assist, as he told me on one occasion, to vindicate right and civilization against might and barbarous atrocities. Nothing fired him more than to hear and read of acts of cruelty which the German army inflicted on the undefended Belgian and French populations. Hence, his patriotism and his unselfish resolve to assist in defeating our oppressors, and his fearlessness in carrying out his Military duties.

I am reminded, too, of his further sacrifice of being precluded from attending regularly as Worshipful Master of the Murdoch Lodge. I was present at his installation, and remember his joy in being Worshipful Master of so distinguished a lodge. He keenly felt that it might be the first and last meeting over which he would preside; but he maintained his usual cheerfulness, notwithstanding the terrible hardships he was about to enter upon. Such were his nature and good qualities, which will always be remembered by brother masons, colleagues, and friends alike.

By CYRIL G. DAVIS.

Having just heard the sad news of the death of Captain Thornton, I feel I should like to express my keen appreciation of his sterling character and genial personality. Though competitors in the business world, Captain Thornton and I were on the best of terms; and I have had many opportunities of estimating his true worth. What particularly appealed to me—as I know must have been the case with many others of his acquaintance—was his invariable "sporting" nature, his imperturbability, and his cheery disposition. In these anxious times, men of his type are a decided asset to the country; and Captain Thornton will be sadly missed from the business and social circles in which he moved.

We could have no finer testimony to Captain Thornton's manliness than the fact that, though under no obligation to do so, he patriotically gave his services to the country almost at the commencement of hostilities; and that he should have been called upon to make the Great Sacrifice is not the least of the tragedies of a calamitous war.

Captain Thornton will be sincerely mourned alike by his friends and erstwhile competitors (and many, like myself, were both), for—in common with Captain Richard Glover, whose loss we have also had reason to deplore—he was a man esteemed by all who knew him intimately, and one of whom the gas-stove trade had every cause to feel proud.

Increase in Benzol Recovery in Russia.

The "Journal für Gasbeleuchtung" learns from Russian sources that benzol recovery in that country has increased enormously of late. The output in 1915 amounted to 600,000 pouds (= about 9670 tons), compared with 50,000 pouds in 1914 and 7000 pouds in 1913. In the Donetz basin, which was previously the only producing district, there were at the beginning of the war 1082 coke-ovens, of which only 358 had bye-product and benzol recovery plant. During the first year of the war, 1200 coke-ovens came into action with recovery plant; and 800 more were under construction. Also coke-ovens, with recovery installations, were erected in the Kusnetzer coal-field in Western Siberia. As, however, these sources did not meet the demand, attempts were made, both in the laboratory and on the large scale, to obtain benzol by the distillation of petroleum naphtha; but the results have not been disclosed. American experiments in the same direction do not appear, however, to our German contemporary to be very promising as regards benzol production on a permanent basis.

Increase in the Price of Gas-Cookers in Germany.—The Union of German Gas-Cooker Manufacturers has announced that, owing to the greatly increased costs of production, the addition to the normal price of gas cooking and heating apparatus made by the firms attached to the Union would be 75 per cent., as from the 20th ult.

Yorkshire Junior Gas Association.—Arrangements have been made by Mr. W. B. Leech, City Gas Engineer, Leeds, for the members to visit the New Wortley works of the Leeds Gas Department, next Saturday afternoon. The special features of the visit will include the oil-washing plant for the extraction of toluol, and the new telpher coke-handling plant.

Gas Profit-Sharing at Baltimore.—The Consolidated Gas, Electric Light, and Power Company of Baltimore have put into successful operation several plans which have resulted in a substantial number of employees and consumers acquiring an interest in the undertaking. More than 1700 consumers are, it seems, now buying stock in the Company, and paying for it in monthly instalments, with their gas and electricity bills; while approximately 225 employees own stock. In addition to this number, about 750 employees are depositing in a savings fund supervised by the Company. These deposits bear interest; and when sufficient money has accumulated to his account, the employee's fund is invested in common stock.

ELECTRICITY SUPPLY MEMORANDA.

The Ultra-Violet Rays Again.

THE old subject of the effect of ultra-violet rays upon eyesight has been revived by an article in the "Electrician;" and, while attempts are made to minimize the effect, the article is quite frank and cautionary. Just as it is better to over-estimate than under-estimate the strength of an enemy, so it is better in the matter of a harmful defect of this kind not to underrate it, but to provide against it. Certain as there is negligence, and the nocuous effects come to be appreciated by the public, trouble will arise that will not be commercially beneficial. By the researches of Drs. Schanz and Stockhausen, of Dresden, of a few years ago, it was shown that lamp development has been accompanied by an increase in the percentage of ultra-violet rays. This is very strongly marked in the case of incandescent electric lamps—the metallic filament and the "half-watt" varieties—the filaments of which are run at a very high temperature. When anyone breathes of ultra-violet rays, electrical people always fail back upon the statement (the "Electrician" does it in an editorial) that it is well known that ordinary glass absorbs ultra-violet rays to a marked extent. No one who has studied the matter will dispute it, nor this: "It will be admitted, therefore, that the light of the tungsten filament as commonly used contains a considerably smaller percentage of ultra-violet light than the spectrum of the light as it leaves the filament." Granting the partial absorptive power of glass, the second submission of our contemporary naturally follows without the saying. But there is no claim that ordinary glass has complete absorptive power. The range of its absorptive power is not limitless; and the absorptive power of ordinary glass has not advanced by a single jot with the increase in the percentage of the ultra-violet rays of which Drs. Schanz and Stockhausen spoke.

Eye Differences and Universal Protection.

Alluding in the article to the case of special work at close quarters to sources rich in ultra-violet light—such as naked arcs—it is pointed out that care is the more to be encouraged because injuries may only reveal themselves gradually. "A person may work with such a light without experiencing discomfort, yet experience severe inflammation of the eyes hours afterwards, while more deep-seated injury might only be revealed very much later." The researches of W. E. Burge show that different eyes have different resisting power to the harmful influences of ultra-violet rays—in other words, it is suggested that certain eyes are predisposed to injury by ultra-violet light, but that the experience in such cases should not be regarded as indicating the necessity for general precautions for all eyes. In our opinion, the question of the necessity for general precautions is rather governed by the fact that people do not know that they are predisposed to eye injury, and "injuries may only reveal themselves gradually." It is doubtless true, says the writer of the article, that within recent years the brilliancy and concentration of light in artificial illuminants have greatly increased, and at the same time such illuminants have become "whiter" in colour, and may therefore be expected to contain larger percentages of ultra-violet light. And, further, "it is not to be gainsaid that constant exposure to the direct glare of such sources as the arc light and the gas-filled glow lamp may have prejudicial effects, and doubtless the ultra-violet component may play some part therein. But the mere effect of the glare of the visible light at close quarters from an unshaded source of this description would also be prejudicial. The obvious remedy would seem to lie in the proper shading and sensible use of such lamps, rather than enclosing them in glass envelopes of special composition." But the writer seems possessed of some amount of uncertainty as to his ground, the absorptive power of glass, shading, and all else notwithstanding, for he says: "It is, of course, conceivable that some minute but cumulative effect of certain rays, even if lamps are so shaded, may exist. But the matter has not yet been investigated sufficiently by physiologists for any definite opinion to be advanced on the point." While in its editorial our contemporary does not assign over-much weight to the fears as to the effect of the ultra-violet rays, it makes an admission and expresses a regret. It admits that sources of illumination of high intrinsic brilliancy—such as the tungsten and the half-watt lamp—are far more likely to produce harmful effect on the eyesight than ultra-violet rays; and it regrets to see the way in which clear glass lamps are still constantly used without any proper shades; and such use is described as "a crude method of illumination." We are pleased to be in perfect accord with our contemporary in this description. Attention to eye defence against high intrinsic brilliancy will also be helpful to annihilate the harm of the untrapped ultra-violet rays.

"Half-Watts" and Outside Lighting.

The arc lamp deserves some amount of sympathy. Its existence on the old lines of magnitude was before the war threatened by the deceitfully titled "half-watt" lamp. The beginning of the war saw a "push" being made in driving the old flickering and spluttering lamp off the streets, with to an extent the view of economizing in labour and maintenance. Then came the lighting restrictions. Some lamps remained unlighted; others were dimmed by various devices. There came a lull in the process of the eviction of the arc lamps from their high pedestals, from which, in times when history was being made in peaceful ways, they cloaked the streets in a patchwork of light and shade. But the manufacturers of "half-watts" are making great preparations for proceeding with the war on arc lamps on the restoration of peace. The efficiency of the new comers in point of candle-power per watt is not so great as that of the arc lamp; but their efficiency in other respects cannot be denied. They have no moving parts, they give a steadier light, and maintenance and labour charges are lower; and these combine to supply a more efficient means as a street-lighting agent. But their high temperature furnishes an item, with the higher consumption, to set to a contra account. The lamps are costly things if many of them were to succumb to the want of affinity between high lamp temperature and bad weather conditions. But the makers have been utilizing war time—the "B.T.H." Company particularly so—in devising weatherproof and well-ventilated lanterns and accessories. The "half-watt" lamps are now made in a range of sizes extending from 15 to 1500 watts, which means from (according to the "candle per half-watt" theory) 30 to 3000 candle power, and variously for pressures between 25 and 255 volts, and so, according to circumstances, for use singly or grouped in series, or at will with transformed voltages. This is outside competition that awaits the gas industry, too, at the end of the war. It will have to be met vigorously, and with an efficient utilization of forces.

Fixed Prices for Cooking, Lighting, &c.

There has been in this country a varied experience with fixed-price charging for electric-lighting service; and in some places it is found that, unless there is close surveillance, the "profit" on the fixed price gradually dwindles until it disappears altogether, and the balance gets on the wrong side. Familiarity breeds not only contempt, but carelessness. Users become indifferent as to the extent and the hours of use. They leave lamps alight unnecessarily, through the departure of the switching-off habit, and the knowledge that the amount of the consumption makes no difference to their pockets. Whatever it is, the price under the contract remains fixed. It is one of the silliest, one-sided pieces of business that ever occurred to, and was adopted by, man. However, foolish as it is, we can hardly imagine central station managers or long-headed landlords in this country taking on at a fixed price the supply of electricity for *ad lib.* lighting cooking, and operating domestic appliances generally. The latitude for waste there would be immense. But there is one place in the world where such a system is running. The "Electrical Times" calls attention to it. It is at Omaha (Nebraska); and in that town there must be some people with strait-laced consciences. A new building there, known as the "Hunter Inn," contains sixty-three suites of apartments. The owner has contracted with the local Electric Supply Company to purchase current in bulk, and this is to be supplied to residents for lighting, cooking, and operating domestic devices. Each tenant pays $3 (12s. 6d.) per month for the entire electric service, and will be free to make unlimited use of it. Cooking ranges to the number of 57 are being installed; while six of the apartments are operated on the hotel plan. It is stated that the rate paid by the owner would permit of the fixed charge to the tenants being reduced to $2·50; but the higher rate is imposed to cover possible extravagance on the part of the users. There is no encouragement there to economy; the economical ones helping to defray the expense of the consumption of the extravagant ones. The owner taking a bulk supply, of course, gets it at a lower figure than ordinary consumers; the suppliers have only one meter and one account to claim attention for the 63 suites of apartments. Our contemporary states that many flat dwellers in this country would be glad to avail themselves of such an inclusive rate.

Small Undertakings and Enterprise.

Enterprise is not something that need be or should be, confined to the larger undertakings, whether gas or electric. Minehead has an Electric Supply Company the Manager of which is very energetic in pushing electric appliances. For instance, he supplies householders with electric heating appliances for a month's free trial; and this, it is said, has proved very successful. There are approximately 300 electric "fires" and "radiators" connected; and "numerous" applications are now being dealt with. The "numerous" may be merely a favourite expression of the "Electrical Times" when telling its readers an electrical tale. The population of Minehead is about 3500, so that the proportion of electric-heaters to population is 1 to 11·6. It would be interesting to know what is the proportion to fireplace-fitted rooms in the town. It happens that, in the September quarter of this year, the only increase in units sold by the Company was for heating and cooking, as the following comparison shows:

	July-Sept., 1915. Units.		July-Sept., 1916. Units.
Private lighting	23,942	..	19,388
Public lighting	467	..	—
Heating and cooking	9,215	..	10,794
Power	6,627	..	5,358
	40,251	..	35,540

The figures for 1913 and 1914 should also have been given. It is pointed out by our contemporary that last year the Company paid

8 per cent. dividend on the ordinary shares, besides placing a sum aside for depreciation; and though the aggregate output is likely this year to be less than in 1915, the sales of current for heating and cooking "may do much to counteract the lessened demand from other sources." If the figures in the tabulated statement are compared, it will be seen that in this one summer quarter at Minehead 4554 less units were sold for private lighting than in the corresponding period of last year, while the increase in the heating units is only about 1500. That is to say, the loss of high-priced lighting units was three times more than the gain of low-priced heating units. We appreciate the use of the word "may" instead of "will" in the quoted sentence above. It may interest our electrical friends to note that in a paper (printed elsewhere in this issue) on "Naphthalene," Mr. Vince, of Minehead, states that the maximum demand for gas is during the months of July to September; and that this year is a record as regards cooking load.

Shocks and Deaths.

The record of fatalities through electricity continues to lengthen in an unpleasant fashion. Barely a week passes without some workman is, through electric shock, sent suddenly to his final rest; and sometimes more than one. Among recent additions to the list is that of John Ratcliffe, who was employed at the works of the Electro Flex Steel Company, Dunston-on-Tyne. He was engaged taking down some disused wire when he was discovered in a sitting position—dead. It was found that a fuse had been left in, and that death was caused by shock due to the attempt to cut the live wire. A boy has recently been killed at the Earl of Dudley's Old Level Works, Brierley Hill. He was playing when he caught hold of an electric-lamp pole, with the result that his clogs became fastened in the wires attached to the pole, one of which he held in his hand. The pressure was only 100 volts, alternating current; while the Home Office regulations consider there is safety in 120 volts alternating current. A man named Walker has met with his death at the works of Messrs. Bolckow, Vaughan, and Co., at Eston, Middlesbrough. He caught his heel in a live wire, and was precipitated to the ground. At the works of Messrs. Thwaite Bros., of Bradford, a workman's arm came into contact with the feed-arm of an electric furnace. He died before reaching the infirmary. An inquest has lately been held at Sheffield into the cause of the death of a man named Theaker. In this instance, a brake was being fitted to an electric-crane; and the man came into contact with 200-volt live wires while climbing down into the cage containing the operating handles. A workman named Permain has been killed at an Acton foundry through electric shock while working at overhead wires. Lately, while engaged in the extinction of a fire which had broken out in a furniture store in Dublin, a member of the City Fire Brigade got in contact with a live electric wire, and seized hold of a colleague who was near by. Both men received severe shocks, and fell from the first floor window of the building. They were taken to the hospital.

COAL ECONOMY AND GAS PRICES IN HOLLAND.

LAST month the Dutch Department of Agriculture, Industry, and Trade issued two regulations regarding the economizing of coal, and means to compel lighting consumers to be sparing with gas and electricity. There were also instructions as to economizing in the use of raw coal; coke being advocated as fuel. It is hinted to municipal authorities that the raising of the price of gas and of electricity for quantities used above a certain maximum may have considerable influence in inducing lighting consumers to be economical; while the authorities themselves are instructed to restrict the use of light in shops, hotels, theatres, &c., by prohibiting wholly or partly the use of light after certain hours in the evening and before certain hours in the morning.

Further, it is stated that, at the beginning of every month, the Administration of Government Coal Distribution are going to inform gas and electricity works as to the quantities of coal they may expect to receive. The supplies of coal to the various towns are to be regulated in such a manner that the stocks at every works will be taken into account. Whenever the Government are of the opinion that the economizing of coals is not sufficiently carried out, smaller supplies of coal will be sent to the offenders. The cause of this Government restriction of the gas and electricity consumption is the uncertain supplies. Most gas-works—more particularly the larger ones—have sufficient coal stocks; but owing to the uncertain supplies, the Government wish measures to be taken to keep stocks intact; the consumption being in accordance with the immediate supply.

The sequel to this Government circular has been a general raising of the prices for gas and electricity throughout Holland. Rotterdam was the first of the large towns to do this. There it has been decided that for gas the normal price of 7 c. per cubic metre is to be maintained for 70 per cent. of the normal consumption—*i.e.*, of the consumption in the corresponding month of the preceding year. For each cubic metre above this quantity, the price is doubled, and becomes 14 c. (2·8d. per cubic metre). For slot-meters, the price will remain at 7 c. for the first 40 cubic metres; the next 40 cubic metres are charged at 9 c.; and the remainder at 11 c. Slot-meter consumers have therefore a small advantage as compared with ordinary consumers. The use of gas and electricity in shops is prohibited between 8 o'clock in the evening and 6 o'clock in the morning.

At Amsterdam, the proposition was still more drastic, but also more complicated. For each month maxima were fixed; and all the gas and current used above this was to be taxed double. These maxima were: 60 cubic metres in January, December, and November; 50 cubic metres in October; 45 cubic metres in February; 40 cubic metres in March and September; 35 cubic metres in April and August; and 25 cubic metres in May and June. For slot-meters, the same figures were to rule. For this proposition, however, there was not a majority; and so the first ideas have been changed. It has now been unanimously agreed to charge the normal gas price of 7 c. per cubic metre for one-half of the quantity consumed in the corresponding month of the preceding year; the surplus to be charged double, with the proviso that the maxima mentioned above will apply when one-half of the normal consumption is less than the maximum fixed for that month. When; for instance, a customer had a consumption of 100 cubic metres in January, 1916—one-half of which is 50 cubic metres—he may use 60 cubic metres at the normal price in January, 1917. Furthermore, the closing hour of *cafés*, bars, &c., is set back two hours and becomes midnight; whereas theatres, &c., are to be finished at 11 o'clock. As to shops, no measures have so far been taken. The shopkeepers are still discussing the best means to adopt.

In the Hague, the surtax on the price is taken over the whole consumption; but with some graduation. The first 40 cubic metres are charged 15 per cent. extra; and the remainder 25 per cent. above the normal price. Industrial gas has over the whole consumption a surtax of 25 per cent.; and slot-meter consumption is also raised in price to 1·5d. per cubic metre.

Amsterdam is taking matters coolly, and regards the new measures chiefly as a raising in the price of gas made necessary by the war. Though the measures did not come into operation until the 6th inst., there is already a considerable decrease in the use of gas, as the greater part of the inhabitants are willing to co-operate with the Municipal authorities. Dealers in gas apparatus have profited, as everyone now tries to get appliances of the most economical make. In Rotterdam, there has been a run on kerosene lamps and kerosene oil supplies. This was assuming such dimensions that the fire insurance companies were compelled to intimate that no fire damages were to be paid in cases where the cause was found in unnecessary and unlicensed stocks of kerosene.

EARLY DAYS OF GAS IN LONDON.

ATTENTION has been drawn by Mr. Walton Forstall, of Philadelphia, to the interesting letter here reproduced from Vol. II. of Lord Granville Leveson Gower's Private Correspondence, 1781-1821, published this year by E. P. Dutton and Co., of New York. The letter is from Lady Bessborough (in London) to Lord Granville Leveson Gower (in Russia).

Sept. 7, 1807.

La lumière et la chaleur vivifie la nature entière, aussi ne peut on vivre sans lumière et sans chaleur, mais c'est maintenant la première fois je crois, qu'on s'avise de les vendre – dorénavant le soleil sera superflu à moins qu'on n'obtienne une patente pour ses Rayons. C'est une rage une coqueluche qui se gagne depuis le Palais jusqu'au plus mince artisan de Londres, la vue quinquagénaire renouvellée, sans un lot de lumière et de chaleur—point de salut. I was interrupted, but must begin again where I left off, and indeed, as there is no other subject thought of or talk'd of, I may as well write of it too. Is it the seizure of Zealand? No! The investing of Copenhagen? No! The invasion? Oh, no! War with Russia? Nothing like it. America? Still less. What can occasion such a ferment in every house, in every street, in every shop, in every garret about London? It is the Light and Heat Company. It is Mr. Winsor, and his lecture, and his gas, and his patent, and his shares—these famous shares which are to make the fortune of all who hold them, and probably will involve half England in ruin, me among the rest, and prove a second South Sea Scheme. Yet it promises fair, if it did not promise too much—*six thousand a year* for every seven guineas seems more than can be possible; but were it hundreds instead of thousands, it is immense. *Seventeen thousand shares* have been sold within these ten days. They were first a guinea, then three, five, seven; they will be twenty, fifty, a hundred; for there is scarcely means of passing thro' Pall Mall for the crowds of carriages, and people on foot and horseback. Ld. Anson has 100, the D. of Athol 200, the Royal Family 200, Ld. Choly 20—everybody some, and I five. There is no resisting it, and I long for you to have some. At first I dreaded its hurting the holders of coal mines; but now they say it will raise the coal trade, as, if it passes, all London will be lit from coal instead of oil. I am not light headed, and only talking to you as everybody talks everywhere at this moment. I went last night to a very large party; I never saw so odd a looking place—something like a cellar with crucibles and strange looking instruments, resembling an alchymist's shop in a Tenier's picture—and there, mix'd and squeez'd together, were fine ladies, a few rabbis, merchants, peers, blue ribbons, and tallow chandlers, all raving for shares and entreating to sign their names first, lest none should be left. That shining lamp which has lit up Pall Mall for this year past has all at once blaz'd up into a comet that bears everything along with it. I only stipulate to know the amount of the forfeit in case of failure, and not answer for the debt of the Company. He only wants a *million* to begin with, and has almost got it already.

On a date to be hereafter announced, the Society of Arts have accepted a paper by Mr. H. M. Thornton, M.I.Mech.E., on "The Application of Coal Gas to Industry in War Time: Its National Importance."

GAS-FIRE CONSTRUCTION.

AN APPRECIATION—AND A CRITICISM.

By Thos. Newton.

The lecture on the "Construction of the Gas-Fire," recently delivered by Mr. Harold Hartley to the Scottish Junior Gas Association, is worth considerably more attention than has hitherto been accorded it; and it is rather unfortunate that the discussion which followed it was somewhat meagre. What discussion occurred seemed to have been devoted more to the technics of fixing gas-fires than to the essentials of the lecture itself, which, for some apparently unaccountable reason, appeared to have been overlooked. This is a real misfortune to the gas industry, inasmuch as discussion not only reveals the weak points of a lecture (if there are any), but it also enables a lecturer to amplify his statements, and adduce evidence in support of his strong points. Mr. Hartley is to be congratulated on the spade-work he has done in connection with gas-fires; and his interesting lecture unquestionably embodies a great deal of research work in different directions.

Standardization of "Fuel."

It is satisfactory to note the efforts that are now being directed towards the standardization of "fuel," although the tabulated results on the "Effect of Radiant on Fire Efficiency" are a little disappointing to those who are compelled to stock a bewildering variety of radiants to suit different fires. It would be helpful to know to what Mr. Hartley attributes the increased efficiency of the "own fuel" as compared with "another maker's fuel." Is it due to the composition of the clay, or the firing, or the design of the fuel; or is it due to the adaptation of the burner to the fuel; or a combination of the lot? We are told that "if an engineer decides to utilize only one pattern of fuel for the various types of fire which he adopts, he may run the risk of materially reducing their efficiency." But, happily, we are also told that "to avoid this, he should carry out a careful series of tests to satisfy himself as to which particular make of fuel will give him the best all-round results in the fires he requires; and, having arrived at a decision, he should then arrange, if necessary to modify the burner-drilling and other details of the fire to suit the adopted fuel." If a material reduction of efficiency can thus be avoided, it would appear that the standardization of fuel is brought appreciably nearer; but the engineer is legitimately entitled to look to gas-fire makers for a little co-operation to bring about this desideratum. Therefore, it is encouraging to note that concentration is being made on a radiant that "may be capable of giving satisfactory results with many of the better known makes of fires."

After all, the standardization of radiants is long overdue; and, in the interests of the industry as a whole, a solution of the problems involved ought not to be long deferred. One sometimes wonders what would be the effect on gas lighting if every burner-maker adopted his own particular standard for glassware and mantles. Although not exactly an analogous case, its significance is apparent. It is therefore to be hoped that every encouragement and assistance will be meted out to those who are working in the direction of the standardization of radiants; and it is further to be hoped that in the near future it will not be necessary for an engineer to institute a careful series of tests, and go to the expense of altering burners, and other details of the fires, in order approximately to accomplish this object. Engineers—particularly nowadays—are far too busy in other directions. Moreover, this is how not to do it, since the labour entailed in a multiplicity of operations throughout the country would be so much wasted energy that might be diverted into more useful channels, especially when it is considered that one authoritative series of tests would suffice.

Burners.

Notable advances have been made within the past few years in the construction of gas-fire burners. Those who had dealings with consumers when the now out-of-date noisy burners were in common use, knew how well-founded were the objections levelled against them. Much business was lost in those days on this account alone. Fortunately, however, through the persevering efforts of gas-fire makers, these objections have been overcome; and both flame and jet silence are now embodied in modern gas-fire burners. It is obvious from the report of the lecture referred to that finality is by no means reached concerning the degree of aëration necessary to obtain the best results. Mr. Hartley appears to favour a low degree of aëration, for he states that "the degree of aëration necessary is determined at present by that required to prevent the sooting-up of the radiants." Other experts claim that the best results are obtained from flames having a high degree of aëration.

The reasons given in support of a low degree of aëration are, in the absence of further evidence, not quite convincing. For example, would not a variation in the quality of the gas, in the opposite direction to that indicated in the lecture, tend to change the relative degree of aëration of the flames of a given gas-fire, and thus bring the flames to a condition favourable to the sooting-up of the radiants? It is stated that "by a normally aërated flame I mean a flame just sufficiently aërated to prevent the sooting-up of the radiants." But is not this sailing too near the wind? One can imagine what would occur, in practice, in the event of a slightly richer gas being turned out, if only for a short time. In all probability, the resultant sooting-up of the radiants would be reflected in a crop of complaints, which the uninitiated would attribute to "dirty" gas.

Radiant Efficiency.

The tabulated effects of aëration on radiant efficiency at varying consumptions represent an interesting comparison between highly aërated flames and normally aërated flames; and, presumably, the inference drawn from these results is in favour of normally aërated flames. But a little consideration will show that an opposite inference can legitimately be drawn. In order to make the point at issue quite clear, it will perhaps be advisable to quote from the lecture, thus: "It will be noticed from these results that, with the normally aërated flames, the efficiency is well maintained over a big range of consumption, but that the falling off in the efficiency of the highly aërated flames with decreasing consumption is quite pronounced, especially at the lower consumptions. Further, that with the highly aërated flame the optimum consumption is probably somewhat greater than with normally aërated flames, and that high aëration gives better results at very high consumptions."

From the results of the tests referred to in the foregoing, the argument is advanced that, inasmuch as greater efficiencies are obtained at low consumptions with normally aërated flames, as compared with highly aërated flames, it is better to adopt the normally aërated flame as the standard, notwithstanding that highly aërated flames give better efficiencies at very high consumptions. But, it may be asked, are not these results capable of being interpreted differently? For example, if the highest efficiency can be obtained from a highly aërated flame—consumption apart, for the moment—why advocate a flame yielding a less efficiency? If a comparatively high rate of consumption, per teat, gives, with a highly aërated flame, the best efficiency, why not have a smaller number of such flames in a given fire, instead of a larger number of normally aërated flames yielding a lower efficiency? Further, if a fire can be produced having a smaller number of highly-efficient flames, instead of a larger number of flames not so efficient, would not the prime cost of the fire be thereby reduced? It is objected that the lowering of the highly aërated fire, after it has been alight for a quarter of an hour or so, lessens its efficiency; but what objection can be taken to the use of a duplex tap? This accessory is generally appreciated by consumers; and it would meet the difficulty referred to.

Mr. Hartley and his firm are to be congratulated upon placing at the disposal of the gas industry the results of so much sustained effort and research in connection with a subject that concerns almost every gas undertaking in the country. Work such as this is thoroughly appreciated; and it is to be hoped that we shall be favoured in future by having the results of work of a similar character again presented to us.

UTILIZATION OF NAPHTHALENE IN THE UNITED STATES.

The melting point of naphthalene is 174° Fahr., and the boiling point 424° Fahr. Its presence in coke-oven gas is considered to be due to the employment of high heats, which cause a partial distillation of the tar, as soon as it is formed, and, incidentally, the formation of naphthalene as one of the secondary products. The troubles thus caused in the condensers and other parts of the apparatus are a general experience. Before the outbreak of war in Europe, little effort was made in the utilization of this substance, and sometimes it was burned as a waste product.

With a dye shortage, however, and general activity in respect to dye manufacture in America, a demand has arisen for naphthalene in connection with artificial colours, and its nitro compounds are essential ingredients of various explosives. It is applied to the pickling of timber, the preliminary tanning of skins, and the manufacture of phosphorus matches. A varnish made with naphthalene as one of the constituents is more liquid than ordinary varnishes, and does not thicken or form a skin on the surface exposed to the air. It is used as a disinfectant, insecticide, and when stuffing animal skins, as it stops the development of mould, and kills fungi in a short time. An ointment composed of equal parts of naphthalene and vaseline is useful for the treatment of cutaneous diseases, and for dressing wounds is as good as carbolic acid or iodoform.

Attempts have been made to use it as fuel in internal combustion engines; but the chief objection is that the engine must be started with gas or some other liquid fuel, as the naphthalene cannot be used until the whole of the working parts are hot enough to melt it. A locomotive operating on this substance has been constructed in France. It is provided with four cylinders, each 5½-inch bore and 8-inch stroke, and at a speed of 950 revolutions per minute will develop 70 H.P. There are two carburettors—one for starting by the use of petrol, and the other for the naphthalene. The latter is cast in one piece with the reservoir for containing the supply of melted fuel, and is fitted with double walls, forming a space in which water at a temperature of 212° Fahr. is caused to circulate, and to maintain a temperature well above the melting point.

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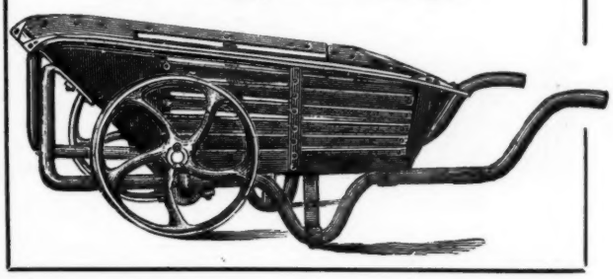

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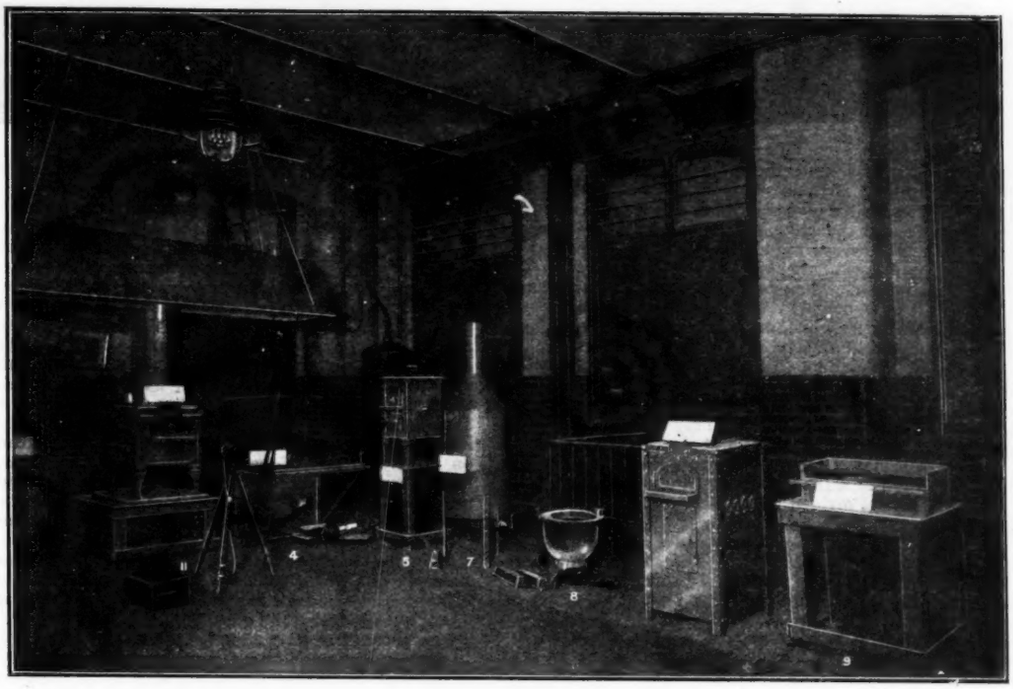
DAVIS FURNACE DISPLAY IN MANCHESTER.

In last week's issue [p. 486], we reported the inauguration, at the Whitworth Street depôt of the Manchester Corporation Gas Department, of a further series of practical demonstrations of the value and utility of gas in the heat treatment of metals for the manufacture of munitions of war, and for other industrial purposes. The exhibitors on this occasion are the Davis Furnace Company, of Luton—the separate concern into which, owing to its rapid development, the furnace department of the Davis Gas-Stove Company has been formed—and they have on view a varied display of their latest types of apparatus, with which, under the superintendence of the firm's furnace specialists, who are constantly in attendance, working demonstrations are, by appointment, daily taking place. It is gratifying to learn that the praiseworthy enterprise being manifested in this matter is proving eminently successful from the point of view of the interest which it is arousing on the part of manufacturers; and their due appreciation of the undoubtedly great advantages of the use of gas for the purposes indicated will bring well-merited reward both to the Gas Department who provide the facilities and to the exhibitors who furnish the appliances for proving what can be done. At the time of recording the opening proceedings last week, it was not possible to add any description of the exhibits; but this is given now.



With the object of facilitating reference to the different furnaces, numbers have been attached to those [only a portion of what are actually on view] to be seen in the accompanying photographs. The furnaces are, it may be explained at this stage, ranged along two sides of a commodious demonstration hall. The remaining space is occupied by a Davis compressor, driven by an electric motor; a number of up-to-date pyrometer outfits—including thermo-electric, resistance, and radiation pyrometers; various samples of work done; small industrial apparatus actually in use; illustrations and blue prints showing in detail the Company's productions; and last, but not least—for it is, of course, on this that success mainly depends—a collection of furnace burners. It is by the special patented self-intensifying construction of the burners which they use that the Davis Furnace Company claim to secure a better heating result than is obtained from the average burner. The small exhibits include a patent two-hole automatic tinman's stove. With this, the removal of the iron automatically shuts off the gas to a small luminous pilot-flame; while when the iron is returned to the stove, the gas need not be turned on unless required.

No. 1 is a Davis single-chamber oven furnace, 18 in. by 18 in. by 9 in., specially suitable for annealing, case-hardening, hardening, and all low-temperature heat treatments. Consuming gas at the Manchester pressure for industrial furnaces, working temperatures up to 1250° or 1300° C. are available. It can, however, be effectively operated at very low gas pressures, and thus gives a wide range of working temperatures. The design is a simple and convenient one; and the means of regulation provided are such as to ensure both maximum service from the gas consumed and ready and perfect control of the oven temperature. Next to it [No. 2] is a twin-chamber muffle furnace, for use with processes in which preheating is an advantage; the working space being 17 in. by 12 in. by 5¼ in. With this, it is possible to maintain the top oven at a dull red heat, with the lower chamber working at full temperature, by burning only slightly more gas than the maximum required for a single-oven furnace. With the Davis patent self-intensifying burners regulated to consume ga at the Manchester pressure, the available working temperature is also from 1250° to 1300° C.

The twin-chamber high-speed tool steel furnace [No. 3], fitted with Davis patent air-blast burners, is supplied with compressed air at 3 lbs. per square inch. Slide-away doors are provided, affording full or only partial access to either chamber, and protecting the operator against radiation from the heated door brick. The lower chamber, which is muffled, can be heated up to 1500° C.; the temperature in the upper oven, of open construction, being, under these conditions, 1000° C. No. 4 is a 60 lb. crucible furnace, with run-way top. The regenerative muffle [No. 5], having special provision for preheating the secondary air passing to the burners, arranged to consume gas at the Manchester pressure, will give an available working temperature of from 1250° to 1300° C. No. 6 is a lead-hardening furnace, designed for melting lead and other soft metals, and for use as a lead, oil, tallow, or salt bath; the heat being supplied by self-intensifying burners, with gas at ordinary main pressure. Next in order are two lead melters, fitted with Davis patent high-power ring burners. The first [No. 7] is provided with an enclosing hood, and is lined with fire-brick, so as to be suitable for best work and continuous hard wear; while No. 8, of cast-iron throughout, is a very inexpensive type intended more for occasional rough work. A useful appliance is the sand tempering plate [No. 9], fitted with high-power atmospheric burner, for gas at main pressure, for tempering, metal colouring, stencilling, &c. This apparatus is supplied either with or without a cast-iron stand.

Coming to No. 10, it will be seen that this is a four-hole forging furnace—4 inch by 2 inch. This furnace is built for use with the Davis patent air-blast burner, supplied with gas at ordinary main pressure, and air at 3 lbs. to 5 lbs. per square inch. The cast-iron casing is lined with fire-brick material, in such a way as to form two oven chambers, one superimposed above the other. The upper chamber acts as a pre-heater; while the lower one forms the high-temperature forging chamber, where a temperature of from 1500° to 1600° C. is obtainable. The mixture of gas and air provided with the air-blast burner is introduced in a vertical

direction at the back, and below the level of the lower chamber. It is deflected downwards by the roof of the chamber, and passes forward through the chamber, escaping by a flue in the roof into the upper chamber, and thence to the flue-outlet. The burners are extremely easy of access; but, at the same time, situated as they are between the legs of the furnace and below the casing, they are thoroughly protected against rough usage or accidental damage. The last type depicted is a loose-top muffle furnace [No. 11], with self-intensifying burners for either low or high pressure gas. The top of this furnace is formed by an arched and metal-bound fire-brick dome, thus facilitating the removal of the muffle and repairs to the furnace-lining.

It has been stated that the photographs do not embrace the whole of the exhibits; and brief mention may be made of two of the things not shown. There is, in the first place, a Davis quenching tank of steel, with heavy-gauge copper container, substantially made so as to be fitted to withstand the hard wear to which it is liable to be subjected. Provided with efficient atmospheric burners of high power, these tanks are equally suitable for oil, tallow, brine, and water quenching, as well as for use as a soda bath and for shellacking and similar operations. The copper containers are electrically tinned on all surfaces. Then there is a 56 lb. lead pot, heated with a high-power ring-burner. The container is of cast iron, supported on a wrought-iron casing, to which are attached three legs and a flue-outlet. The casing is lined with thick asbestos sheets; and the melter is provided with a bottom deflector plate.

The Davis patent self-intensifying burners (for gas pressures from 15-10ths to 20 lbs. per square inch), of which selections are displayed, are constructed to generate a very highly aërated and intimately associated mixture; the mixing being accomplished by a special grating, which also provides a means of pre-heating the secondary air necessary to complete combustion, thereby intensifying the powerful flame and reducing the necessary consumption of gas. The high-power ring-burners—supplied for use with high-pressure gas, as well as natural draught furnaces—have also a special mixing grating. They are made in two cast-iron parts; the larger casting comprising the air-injector, mixing-tube, and atomizer. In the other casting are drilled the flame-holes. The patent air-blast burners (of which one is exhibited in Manchester, in part section, to show the exact construction) are designed for use with air-pressures of 3 lbs. to 7 lbs. per square inch, and are particularly suitable for operations where high temperature or great concentration of heat is required. This burner, it is said, adequately meets the essential requirements of an efficient air-blast burner—namely, a readily manipulated gas and air regulator, and an intimate admixture of gas and air, in order that the advantages of the air-pressure may be fully utilized.

CITY AND GUILDS OF LONDON INSTITUTE.

The Work of the Last Session.

In an abbreviated form, there has been issued the report of the work during the session 1915-16 of the Department of Technology of the City and Guilds of London Institute. On this occasion, in view of the shortage of paper and the desirability of curtailing expenditure as far as possible in all directions, the questions set at the examinations of 1916 are not reprinted as an appendix to the report; and for the same reasons the publication of extracts from the reports of the examiners on individual subjects, which has hitherto been customary, has been suspended. The report (which is signed by Mr. Morton Latham, M.A., Chairman of the Technological Committee) contains, however, some very useful hints for students.

In the first place, figures are quoted to show the effect of the war on the work of the department. The number of classes registered in technological subjects fell from 5049 in 1913-14, to 3961 in 1915-16, while the students in attendance decreased from 55,996 to 35,203. The number of candidates presented for examination shows an even greater falling off; the figures being 23,119 in 1913-14 and 8508 in 1915-16. This last-mentioned condition is accounted for by the fact that many students after commencing their studies found themselves unable to continue the full time. In spite of war conditions, the examinations were conducted throughout the country, though two of the exceptional difficulties experienced are recorded. An air-raid on the evening of May 2 necessitated the suspension of the examinations at many centres on the North-East Coast. Fortunately, it is added, more than half the examination time had passed before notice was given for the lowering of the lights; and it was possible for the Institute's Examiners to make reasonable allowance for the curtailment of the candidates' work. Owing to the rising in Ireland, the arrival of the question papers at many Irish centres of examination was delayed; but arrangements were made to hold the examinations at later dates—under due precautions to ensure that no candidate was acquainted with the questions that had been set.

The percentage of candidates successful in passing stands at 61·5, as against 63·2 in 1915. Although not uniformly the case, it is said that the falling off in the quality of the work done has been more marked in Grade I. than in the Final papers. The centre that presented the largest number of candidates—238 in all, of whom 163 were successful—was the Municipal School of Technology, Manchester, which was followed closely by the Municipal Technical Schools of Bolton and Birmingham. At the different centres, there were 147 students in "Gas Engineering" (compared with 215 in 1915). Of these, 109 presented themselves for examination, and there were 84 passes; the percentage of failures being 22·9. In "Gas Supply," there were 320 students (against 448); and of these 102 were examined, and 75 passed—showing a percentage of failures of 26·4. There were 417 students in "Gas-Fitting" (against 482), of whom 147 presented themselves for examination, and there were 108 passes. In "Coal-Tar Distillation," 23 candidates were examined, and 19 passed; while in "Coal-Tar Colouring Matters," 8 were examined, and 4 passed. In the Final examination in "Gas Engineering," 3 passed in the first class, 34 in the second, and 9 failed; while in the grade below the passes were 12 and 35, the failures 16. In the Final examination in "Gas Supply," 7 candidates passed in the first class, 10 in the second, and there were 20 failures; while in the grade below the passes were 32 and 26, the failures 7. With regard to "Gas-Fitting," the figures were: Grade I., passes 33, failures 18; Grade II., passes 46, failures 14; Final, passes 29, failures 7.

As the result of conferences with the Institution of Gas Engineers, it has been decided that next year the practical tests in "Gas-Fitting" shall form an integral part of the Grade II. and Final examinations, and shall be taken shortly after the written papers, instead of as a qualifying examination preliminary to the written papers. The syllabuses in "Gas Engineering," "Gas Supply," and "Gas-Fitting" have undergone some revision; while that in "Heating and Ventilating Engineering" has been arranged to ensure, as far as possible, that candidates should have both "practical experience and an intelligent appreciation of scientific principles."

Referring to the Examiners' reports as a whole, it is remarked that candidates frequently enter upon their technical instruction very poorly equipped in the matter of general elementary education. Cases in which candidates enter upon lengthy descriptions

and discussions which have no real bearing on the question asked, or fail to comply with the definite instructions given in the question itself or at the head of the paper, are far too frequent; while obligatory questions are often ignored, with the result that no credit can be given to a candidate for the rest of his work. The importance of clear sketches of apparatus or machine details needs to be emphasized; and also the verification of answers by common-sense methods should be inculcated—some candidates putting forward absurd results, when a moment's thought must have shown them that their calculation must be at fault. It may be doubted, the report says, whether even now the nation in general is alive to the full importance the technical instruction of its artisans will have when war conditions have passed away. A vague opinion that all is not well with the technical training of the working population is no doubt widely held; but much more is necessary. Speaking generally, "employers must change their attitude towards technical training, so that those who foster the education of their younger employees should become the great majority, instead of the minority, and so that attendance at continuation schools and day schools, or, if this be too much to expect, at least at evening technical classes, should become the rule. Nothing short of a strong national movement in this direction can prove adequate to meet the requirements of the case. There is need for reform in the primary school, in the secondary school, in the technical school, and in the university—not with a view to turning men into machines, but to provide them with the raw material of knowledge, which they need for intellectual development."

The Institute once more record their thanks to the members of the Advisory Committees (among whom are the Council of the Institution of Gas Engineers), for the assistance they have given in various ways; and to the different bodies (which include the Society of British Gas Industries) offering special prizes. The programme for the 1916-17 session, it may be added, was noticed in the "JOURNAL" for Aug. 1 [p. 209]. It contains syllabuses and regulations with respect to the examinations and the registration of classes, a list of teachers registered by the Institute as qualified teachers in technology, and the different prizes and medals offered. In many of the subjects the examination fees have been altered.

POWER PRODUCTION.

THE "MONEY SIDE" OF TOWN'S GAS AND PRODUCER GAS INSTALLATIONS.

By M.J.INST.E.

COMPARATIVE TABLES OF RUNNING COSTS CONTINUED.

A CLOSE perusal of the various tables given last week [p. 495] will be found to throw a great deal of interesting light upon the relationship which the various items bear to each other, and to the total running costs. They also illustrate the necessity for dealing with the whole of the costs when making comparative estimates, as against the rough-and-ready, and manifestly improper, method of dealing with fuel charges alone.

As an instance, take the case of the 80 B.H.P. set running at a plant load factor of 50 per cent. for 3000 hours per annum, as shown in Table No. 3. Under these conditions, it is found that the producer gas installation generates 1 B.H.P. hour at a cost of 0·788d., of which total 57·1 per cent., or 0·450d., is for anthracite fuel at 42s. per ton; while the remaining 0·338d. represents in total the charges for which the other various items are responsible. Turning to the town's gas installation, it will be noticed that the total cost of running is 0·770d. per B.H.P. hour, of which total 70 per cent., or 0·540d., represents the charge for gas alone.

Turning back to the producer gas set, let it be assumed that the cost of anthracite is reduced 33·3 per cent.—namely, from 42s. per ton to 28s. All other charges remaining the same, the fuel cost per B.H.P. generated at the revised figure for anthracite will now stand at 0·450 × 28 ÷ 142—namely 0·3d. per B.H.P. hour; while the total running costs will be 0·3d. *plus* 0·338d., equals 0·638d. per B.H.P. hour. Now, with anthracite at 42s. per ton, and town's gas at 2s. per 1000 cubic feet, the respective costs per B.H.P. hour have been shown to be 0·788d. and 0·77d. The difference of 0·018d. is very small; so let it be assumed that these costs are equal, and proceed to estimate the reduction in the price of town's gas which would have to take place in order to bring the cost of operating the town's gas installation down to the figure at which the producer gas installation is turning out power with anthracite at 28s. per ton—namely, 0·638d. per B.H.P. hour.

With town's gas at 2s., the total cost of running is shown to be 0·770d. per B.H.P. hour, of which 0·540d. is for fuel, and the remaining 0·230d. being the amount for which the other items are collectively responsible. The latter charges remain the same, and leave the item for fuel to stand at 0·638d. *minus* 0·230d., equals 0·408d. if the respective costs are to be the same. This means that, to enable the town's gas plant to generate power at the same cost as that at which the producer gas plant is working with anthracite at 28s. per ton—namely, 0·638d. per B.H.P. hour—the price of gas must be reduced from 2s. per 1000 cubic feet to 2 × 408 ÷ 540, equals (say) 1s. 6d. per 1000 cubic feet, or a reduction of 25 per cent.

Let us take the case of a further reduction, and assume that the price of anthracite has fallen 50 per cent.—namely, from 42s. to 21s. per ton. As a result, the total cost of power production would fall from 0·788d. to 0·563d. per B.H.P. hour, at which latter figure the town's gas set would generate power with gas at about 1s. 3d. per 1000 cubic feet—a reduction of 37·4 per cent. on the original price of 2s. per 1000 cubic feet.

Summarizing, the respective costs of power per B.H.P. hour are equal in both the producer gas and the town's gas installations with the following rates for fuel pertaining:

(*a*) With anthracite at 42s. per ton and town's gas at 2s. 0d. per 1000 c.ft.
(*b*) ,, 28s. ,, ,, 1s. 6d. ,,
(*c*) ,, 21s. ,, ,, 1s. 3d. ,,

It will further be noticed that whereas a reduction of 33·3 per cent. in the price of anthracite reduces the total cost of power production from 0·788d. to 0·638d. per B.H.P. hour, a 25 per cent. reduction in the rate for town's gas will accomplish the same result in the case of the town's gas set. Again, by a 50 per cent. reduction in the price of anthracite, the total power costs are reduced from 0·788d. to 0·563d. per B.H.P. hour, which latter figure can be attained by the town's gas plant consequent upon a 37·4 per cent. reduction in the cost of its fuel.

A perusal of the foregoing figures will make it very clear that, in handling estimates of comparative costs, fuel charges are by no means the deciding factor, and that all the items bearing upon the respective cases should be carefully and individually considered with a due regard to the local conditions. Any comparative estimates formed on the basis of fuel charges alone must, in the majority of cases, result in favour of the producer gas installation; and it is only when these other items which go to make up the total costs of power generation are taken into account that the real commercial efficiencies of the respective plants become apparent.

Neglect to make due allowance for the charges, other than for fuel, which are inseparable from the operation of producer gas installations may easily result in the loss of power business, inasmuch as the small power user does not usually possess the technical knowledge which would enable him to form a fair estimate of the respective costs of working a town's gas as against a producer gas installation, having due regard to the conditions of his particular business; and he is very liable to be influenced by the admittedly low fuel charges which are a characteristic of the latter type of plant. If his estimates are to be of any real value, they must include several items quite distinct from, and additional to, the charge for fuel for the producer; the collective effect of such items upon the total cost of power production being to bring the latter figure to a value which may be twice, or even three times, as much as the bare fuel charge.

In order to illustrate this argument, take, for an example, the case of the 80 B.H.P. producer gas installation working 3000 hours per annum on an average plant load factor of 50 per cent., as shown in Table No. 3. The total cost of power generation is seen to be 0·788d. per B.H.P. hour, of which 57·1 per cent., or 0·450d., is expended in fuel for the producer. Now assume that this same plant, working under the same conditions, is running in a locality in which anthracite fuel is obtainable at 21s. per ton. The other factors remaining the same, the cost of power production will fall from 0·788d. to 0·563d. per B.H.P. hour; while of the lower figure 0·225d., or 40 per cent. of the total cost will represent the cost of fuel into the producer. Thus with fuel at 42s. per ton, the cost of fuel alone must be multiplied by a factor of (say) 1·75 to get at the total running costs; while with fuel at 21s. per ton, this factor rises from 1·75 to about 2·5—in other words, in the latter case the total cost of power generation will be two-and-a-half times as much as the bare fuel charge.

This example must show that any estimates formed upon the fuel charges alone can not only be valueless but must be seriously misleading, and may result in the output of a factory being handicapped by high initial charges in regard to the costs of power generation. In the case of the town's gas installation, the discrepancy between total costs and fuel charges will not be so great as in the example just cited; but it exists to a large degree, and cannot be neglected if a fair comparison is to be made.

THE ENGINE.

A question which is often asked is: "What alterations are necessary to enable a suction-gas engine to operate successfully upon a town's gas supply"? No alterations whatever are necessary, unless a readjustment of the gas regulator and the air baffle can be termed an alteration. Provided that these adjustments are so set as to ensure the correct proportions of air and gas being drawn into the combustion chamber, the same engine will operate as satisfactorily upon 130 B.Th.U. producer gas delivered into the cylinder at a negative pressure of (say) 8 or 9 inches of water as with 560 B.Th.U. town's gas at a pressure of 2 or 3 inches above atmosphere. As has already been pointed out, however, the mean effective pressure available behind the piston when using suction gas as a fuel is less than that obtainable with a town's gas supply, and, as a result, any engine will develop from 15 to 20 per cent. more power when running on the latter fuel than when working in conjunction with a producer-gas plant.

In connection with producer gas installations a town's gas supply is frequently laid on, and fulfils the dual purpose of a standby to the producer and a means for ensuring an easy start; the engine being started upon the town's supply and turned over to the producer as soon as the latter has been drawn up to an activity by the working of the engine. This practice is a sufficient

answer to the query as to whether a town's supply is suitable for a producer-gas engine, or *vice versa*.

Electric ignition is a standard feature in the equipment of the producer-gas engine, and must be fitted to a town's-gas engine if it is desired ever to run it on a supply of producer gas. Large engines, and engines entrusted with important duties are frequently fitted with duplicate magnetos. Magneto ignition is fast becoming a standard fitment on all but the smaller powered engines, irrespective of the nature of the supply on which they are intended to work.

General.

The relative advantages of town's gas and producer gas as a fuel for the operation of power plants can only be decided after the closest survey under which any particular plant is working. In forming the estimates which have been given in this article, only those items which have an actual bearing upon the cost of running the engine have been taken into account. The fuel consumption in the cases dealt with includes all stand-by losses; but no allowance has been made for the attendance necessary to ensure an adequate supply of good quality gas for the starting-up of the plant at the beginning of the day's run and after the shut-down for meals.

Generally speaking, however, while in the case of large plants the producer gas installation has been proved to be the most economical power producing proposition in the world—not even excepting the Deisel engine—it is a very debatable point whether the admittedly excellent economy of such plants confers any real financial benefit upon the user of (say) units of below 100 to 150 B.H.P. capacity, provided a supply of town's gas at an average rate is available.

There are certain factors bearing upon the use of such plants which cannot be expressed on a basis of pounds, shillings, and pence, such as, for instance, the dangers of explosion and of poisoning should an escape of gas occur in connection with the producing and scrubbing plant. So far as the first-named risk is concerned, the degree to which it may exist depends largely upon the human element, upon which same factor the question of maintenance costs is far more largely associated than is the case with a town's gas installation. As regards the risk of poisoning among workpeople and those working in the neighbourhood of the producers, much depends upon the human element and also upon the manner in which this portion of the plant is housed. It must be remembered that carbonic oxide gas is an active poison, and an escape of the gas into (say) a confined engine or work room may have serious consequences.

In conclusion, the benefits accruing from the use of producer gas plants are chiefly confined to comparatively large installations, in connection with which the general working arrangements and the staffing are such as to minimize the risk and inconvenience which, compared with a town's gas installation, the employment of these plants must necessarily involve. Then, again, in connection with such plants there is a limit, having regard to capacity, below which it will not pay to instal bye-product recovery plant; and it is above this limiting figure that the noted economy of such plants becomes apparent.

For small and moderate sized power installations—say, below 200 B.H.P.—the value of an unlimited supply of clean gas of high and constant calorific power, as obtained from the town services—on tap so to speak day and night and ready for use at a moment's notice—cannot be over-estimated, and, properly exploited, must result in a victory for the latter fuel in the case of plants of moderate capacity other than those whose geographical position, capacity, or loading are naturally favourable to the employment of the producer gas plant.

RESIDUAL PRODUCTS FROM COKE-OVENS AND GAS-WORKS, AND PRODUCTION OF DYE-STUFFS IN THE UNITED STATES DURING 1915.

The utilization of the residual products from coke-ovens and gas-works continues to be followed with great activity in the United States. Statistics recently compiled by the Government Geological Survey show that during the year 1915 more than 51,340,000 gallons of tar were obtained from oil and water gas-works, nearly 48,000,000 gallons from coal-gas plants, and 138,400,000 from coke-ovens—making a total of 237,740,000 gallons, valued at $6,260,000. About 42 per cent. of this quantity was furnished by gas-works; and while the average value of the gas-works tar was 2·1 c. per gallon, that of the tar obtained in coke-ovens was 2·6 c.

Some 50,700 tons of ammonium sulphate were produced at the gas-works, and 147,000 tons from the coke-ovens. The total was about 198,000 tons, representing a cash value of $11,175,000, and averaging $56·4 per ton. The gas-works also produced 336,213 gallons of benzol, drip oil, and holder oil, valued at $28,281, or 8·4 c. per gallon. The benzol products extracted at the coke-ovens amounted to 16,600,857 gallons, valued at $7,337,371—an average of 44·2 c. per gallon. Some 223,000 lbs. of naphthalene from gas-works realized $3565; and 465,865 lbs. from the coke-ovens were valued at $46,959. The coal-gas works also sold 1,696,326 tons of gas coke for $7,222,744, or an average of $4·25 per ton, and 27,000 tons of retort carbon, which realized $183,170, or $6·73 per ton. The total output of coke from the ovens was 14,072,895 tons, valued at $48,538,325, or $3·45 per ton. The total value of all the products was $80,816,975, of which gas-works furnished $12,383,426. The total production of coke and carbon was 15,796,461 tons, valued at $55,964,239.

It will be observed that while a large yield of benzol is credited to the coke-ovens, in addition to the tar, no account is taken of the benzol content of the crude tar, which represents a considerable proportion of the total production of this substance. Also there is a remarkable difference between the value put on naphthalene from gas-works and coke-ovens respectively. The returns are evidently confined to the actual works production only, and do not include those extracted by subsequent treatment at the distillers or chemical works.

A meeting of the American chemical and kindred societies was held at New York at the end of September, and secured record attendances; a noticeable feature being the prominence accorded to tar products and dyes. The second annual exhibition of chemical industries was held conjointly with the meeting, and comprised 190 exhibits, as compared with 83 last year. More than half the exhibitors showed coal-tar products, intermediates, or dyestuffs.

A Government census of dyestuffs, issued about the same time, gave a list of imports under their trade names; and Dr. Norton, who was responsible for the preporation of the report, said that it included information about 8000 dyestuffs, and that whereas they formerly imported 25,700 tons of these subtances, to-day they were supplying the greater part of the demand by native industry, and within six months the home production would be equal to the normal demand. The output of dyes had increased wonderfully during the last two years; thirty new dye undertakings having been established, and now in full operation. They were producing fully up to the normal demand for black colours, and nearly up to that for blues. They had been progressing at a slower rate in respect to various other colours; and while some time would be occupied in developing the production of a large variety, he was confident in the national ability to do so. The census of the dye industry was the first of the kind that had been undertaken in any country. Before the European War, they were accustomed to import 2500 tons of aniline and aniline salts annually. In the year 1913, the American dye-works produced 3000 tons of coal-tar colours—principally from German intermediates; but in 1916 they would manufacture more than 15,000 tons from American coal-tar crudes. In case of war, the Government would require, in addition to its standing staff, the help of all established undertakings, whether organized bodies or individuals.

Dr. Herty, the President of the American Chemical Society, complained of an important defect in the General Revenue Bill, which contained a provision excluding indigo, alizarin, and their derivatives from the special duty, of 5 c. per pound, imposed on all other imports of dyestuffs for which there was no technical or scientific justification; and these substances constituted 29 per cent. of the dyes used in the United States. At least 10 per cent. of the dyestuffs could not at present be manufactured in America, because of existing foreign patents. The possibility of the expansion of the home industry to the extent of 60 per cent. of the consumption values would be precluded by the Bill. He also suggested immediate provision by the Government for the storage of large quantities of toluene.

One important effect is the demand for coke-ovens. There are now 2236 under construction, of which 2110 are of the Koppers type, bringing the total up to 8992 bye-product ovens, capable of carbonizing 43,694,000 tons of coal per annum, and producing 32,606,000 tons of coke and 113,760 tons of ammonia. Since the ammonia consumption in 1915 was 70,000 tons, the ovens when all in full operation would strain the market; and more would be heard in future about ammonia fertilizers, &c.

Thermal Decomposition of Low-Temperature Coal Tar.—As the result of decomposition experiments carried out at temperatures of 450° to 800° C. on the low-temperature tar obtained by distilling coal *in vacuo* at 450° C., Mr. D. Trevor Jones, of Saltcoats, stated in a paper read before the Glasgow Section of the Society of Chemical Industry that he had arrived at the conclusion that the process of ordinary coal-tar formation consists for the most part of a decomposition of low-temperature tar into higher olefines, and their subsequent condensation to aromatic substances. He said that the tar experimented with had been previously shown by Jones and Wheeler to consist largely of naphthenes, paraffins, olefinic bodies, phenols, and methyl naphthalenes. When it was decomposed at 650° C., there was a rise in the specific gravity of from ·960 to 1·043. This rise was to be attributed partly to the formation of aromatic bodies, but to a much greater extent to the creation of fresh olefinic linkages. Examination of the gaseous products showed that olefines other than ethylene were at a maximum at 550°, and they declined steadily, practically disappearing at 750° C. Their disappearance synchronized with the appearance of naphthalene, and with a marked rise in the hydrogen. Benzene and its homologues were formed to a small extent from the corresponding naphthenes by direct elimination of hydrogen. Hydrogen was produced in moderate quantities (25 to 35 per cent.), chiefly from the last-named source, till 750° was passed, when there was a steep rise in the curve. Acetylene played a quite insignificant part in coal-tar formation.

VISIT TO THE NECHELLS (BIRMINGHAM) GAS-WORKS.

Advantage was taken last Saturday afternoon by a good number of members of the Midland Junior Gas Association of an opportunity of visiting the Nechells works of the Birmingham Corporation Gas Department. It was natural that there should be a desire to take part in the meeting, in view of the fact that the circular sent out by the Hon. Secretary (Mr. W. J. Pickering) had stated that, by permission of the Gas Department, there would be an inspection of the benzol recovery plant and other interesting installations—a promise which was amply fulfilled.

It is just three years since the Association went over the Nechells works; and the conditions under which the Birmingham Corporation Gas Department have in the meantime been, and still are, working, in the matter of demand for gas, being known, it was naturally expected that changes would have taken place about the works; and they have. New plant has been installed; and other work the visitors had the good fortune to be able to examine in course of erection. The very limited amount of daylight available made it, of course, impossible to see everything thoroughly; and so those in charge wisely determined to confine attention to certain sections—the benzol plant, the new retort installation, the coal-test plant, the central laboratory, and the telpher system. On arrival, the party—unfortunately not accompanied by their President (Mr. G. C. Pearson), who was kept away by indisposition—were met by Mr. E. B. Tomlinson (the Engineer of the works) and Mr. E. W. Smith (the Chief Chemist); and to conveniently small parties everything in their respective departments was thoroughly explained by these gentlemen and the following members of their staffs: On the works, Mr. R. A. S. Browning (Works Superintendent), Mr. Pinkney (Works Foreman), Mr. W. S. Smart (Clerk of Works to the new retort-house), Mr. L. H. Thomas (Chief Draughtsman), and Mr. F. S. Townend. On the toluol plant, Mr. T. F. E. Rhead; in the laboratory, Mr. Pickering, Mr. A. R. Myhill, and Mr. G. S. Garrett.

The Toluol Plant.

To the explanations given during the inspection of the benzol recovery plant, was added the following description by Mr. E. W. Smith, which enabled the visitors to clearly follow the process from beginning to end.

Description by Mr. E. W. Smith.

The Nechells plant was the first of fourteen plants erected under the direction of Captain Hilton for the High Explosives Committee of the Ministry of Munitions. The experience gained on this plant has been used by others subsequently installing toluol plants.

The gas is washed in two 5 million cubic feet centrifugal washers, worked in parallel when on full make. The wash-oil is creosote, of which from 50 to 70 gallons pass through the circuit per ton of coal. The oil, containing 3·5 to 4·5 per cent. of distillate up to 120° C., runs from the washers to store tanks, from which it is pumped to the constant-level feed situated above the plant. From here, the oil runs through the crude benzol economizer; its temperature rising from 24° to 70° C. The benzolized oil then passes through the two superheaters worked in parallel, containing steam-coils, where its temperature is raised to about 120° C. Some vapours are driven off, which are carried to the top section of the still. I believe it would be better to take these vapours direct to the condenser. The hot oil is then run into the still about two-thirds of the way up, at either side. The hot oil passing down the still is treated with live steam at about 5½ lbs. pressure. The debenzolized oil passes from the bottom of the still at a temperature of about 110° C., containing less than 1 per cent. of light oil, which distils over below 120° C. The water-content of the debenzolized wash-oil is rarely higher than 0·5 per cent. The oil is then cooled through a series of water-cooled gill coolers to 22° to 26° C.

The crude benzol from the economizer passes through a condenser to store tanks for fractionation. It has a distillation of about 60 per cent. at 120° C. This crude spirit, on fractionation, has the following composition at the present time:

3·0	per cent.	Fore runnings, first drop at 44° C., 90 per cent. at 80° C.
50·0	„	Unwashed benzol, first drop at 76° C., 95 per cent. at 90° C.
15·0	„	Unwashed toluol, containing 84 per cent. toluene.
10·0	„	Unwashed solvent naphtha, first drop at 142° C., 90 per cent. at 160° C., and containing 2·3 per cent. toluene.
22·0	„	Residue consisting of light boiling fractions of creosote, saturated with naphthalene when cold.

The fractionating stills, each taking a charge of 2400 gallons, are heated with coil and open steam, depending on the stage of fractionation. The vapours pass up a dephlegmating column consisting of a series of perforated plates; the condensed spirit returning to the still from tray to tray through luted pipes. The vapours leave the column and pass through a water-cooled dephlegmator; the temperature of the outlet water being varied for the particular fraction that is coming over. The distillate is then cooled and run to store tanks. To obtain satisfactory products, intermediate fractions must be taken consisting of:

Fore runnings—Benzol.
Benzol—Toluol.
Toluol—Solvent naphtha.

These must be refractionated after sufficient has been accumulated of each to make a full charge. The two most important factors in fractionation are easy regulation of steam, including constant pressures, and a constant pressure of water to the water-cooled dephlegmator or analyzer. Without these, fractionation is chaos, and worry and labour are increased enormously.

The efficiency of extraction depends on many factors, among which may be enumerated:

1.—Efficiency and time of contact between the gas and the wash-oil in the washers.

2.—The condition and type of wash-oil. [Mr. Rhead, the Chemist in immediate charge of the plant, will deal with this matter in his paper to be read before the Association in January.] The wash-oil should be partially changed regularly, even though a tar-free gas is being washed. When using 50 to 70 gallons per ton of coal, I am of the opinion that 10 per cent. per week should be taken out of circulation.

3.—Temperature of wash-oil. This should be as low as possible, and certainly not higher than 22° C. for the best working results.

4.—Efficient extraction of crude benzol in the still from the wash-oil. This should be reduced to from 0·3 per cent. to 0·5 per cent. if possible.

Many other considerations arise; but they may all be placed under one or other of the above heads.

Much experimental work has been carried out on the effect of washing on the illuminating power and calorific value, and on the sulphur compounds in the gas. It may be taken generally that each gallon per ton extracted has meant a reduction of 12 to 14 B.Th.U. and 2·5 to 3 candles. The sulphur compounds have been reduced by about 11 grains per 100 cubic feet; and I hope this figure will be improved. It must not be overlooked, however, that part of this sulphur is returned to the gas with the fore runnings, which also give valuable illuminating power and calorific value enrichment.

When the wash-oil is cold, naphthalene is extracted from the gas; but when it is warm and already contains a high percentage of naphthalene, the latter may be added to the gas. In any case, naphthalene troubles are likely to be increased owing to the extraction of those hydrocarbons which either hold the naphthalene in "gaseous solution" or which are absorbed by the naphthalene if any of the latter comes down in the services. This solution would then run to the syphons.

Means must be continuously employed to counteract these troubles. The plant was designed to deal with a maximum of about 1300 gallons per day of crude benzol. This has been much exceeded; and very careful working is required to cope with the increased quantities. The plant is run by a Senior Chemist, and requires one stillman and one laboratory tester per shift. They have charge of the washers, crude still, fractionating stills, and the rest of the essential plant, excluding the boilers.

New Carbonizing Plant.

Shortly after Mr. Tomlinson's appointment at Nechells, some fifteen months ago, he found himself up against the question of extensions. The Birmingham consumers were continually taking more gas, and limits of output were being rapidly reached. At that time the producing capacity at Nechells was 5 million cubic feet per day from inclined retorts, 3 millions from the "intermittent" verticals, and 7 millions from the carburetted water-gas plant; and it was found necessary to increase this capacity by from 4 to 4½ million cubic feet per day, and to do it at once. What had to be done was to fill a retort-house erected some ten or twelve years ago, and time being of the essence of the matter, it was necessary to adopt the easiest means of doing this. A vertical installation would have needed structural alterations involving considerable delay, even could they have been carried out at all under prevailing conditions; and therefore the most simple method was to put in horizontal retorts in two ranges of sixteen beds, eight retorts to a setting, in two vertical tiers. The retorts are 24 in. by 16 in. by 20 feet through. The charging and discharging are carried out by means of Fiddes-Aldridge machines, with the travelling motor quite separate from the charging motor proper, but with both motors controlled by the same controller. This obviates the possibility of the man in charge, in a moment of thoughtlessness, starting the machine to travel while any part of the apparatus remains in the retort.

There are De Brouwer hot-coke conveyors for removing the coke from the house to ferro-concrete storage hoppers outside; each hopper holding about 14 tons. From these hoppers the coke is taken by telpher to wherever it may be desired to deposit it. It can be placed in the town trade screening plant, the Sunday coke-hoppers, the truck trade screening plant, or to stock. The telpher skips, which hold 2 tons of coke, are lowered into a pit alongside the concrete storage hoppers, and are filled from a shoot by Messrs. R. Dempster and Sons' antomatic door opening and closing arrangement. By this device, the weight of the empty skip, when it rests on the bottom of the pit, is made to open the door communicating with the hopper, and when the skip is full

the added weight imparts to the mechanism another movement by which the door is closed. The telpher plant is designed to deal with all the coke made at the Nechells works, and handles approximately about 750 tons a day. It has been so arranged that it can take coke from the horizontal, vertical, or inclined retort houses; being linked-up with the original coke plant put down for the inclined installation. The hot-coke conveyors already referred to are so arranged that the direction of travel can be reversed, in order to deliver the coke at the opposite end of the house, and on to the conveyor used for the "intermittent" vertical retort coke. All through, the scheme is a combination of conveyors and telphers—that is to say, the telpher does not enter any of the houses.

A point which may be mentioned here is the provision of safety switches in suitable positions about the works, connected-up in such a manner that, when any portion of (say) the coal-handling plant, with its several motors, is temporarily put out of action, the man in charge at that particular spot can run to the switch, press the button, and stop the whole series of plant. In the event of accidents this is a very valuable safeguard; and it avoids risk of breakdown through any over-loading of the plant. In fact, the switches do not cost much; and they are found very useful.

The need for this additional carbonizing plant being urgent, it was decided to divide the contracts up, so as to ensure completion in time for the greater part of the installation to be in operation to meet this winter's requirements. The contracts were therefore given out as follows: Retort-benches, bench ironwork, hoppers, and chimneys, Messrs. Thomas Vale and Sons, Limited; coal-handling plant, Messrs. W. J. Jenkins and Co., Limited; Fiddes-Aldridge charging machines, Messrs. Aldridge and Ranken; coke-conveyors and telphers, Messrs. R. Dempster and Sons, Limited; town and truck trade coke-screening plant, Messrs. W. J. Jenkins and Co.; and large truck trade coke-screening plant, Messrs. Nortons (Tividale), Limited.

The "intermittent" vertical retorts, which are at the end of the house in which the horizontal settings are now being placed, have been entirely re-set, exactly on the original lines, during the past summer. Modifications have been introduced, however, in connection with the hydraulic mains. The agitators which were originally fixed have been removed, and "Nelson" patent tar-towers have been adopted—a liquor seal now being worked in the hydraulic mains.

The Coal-Testing Plant.

The completeness of the Birmingham coal-test plant is a matter of general knowledge. It consists of a horizontal house with stoking machinery, a Woodall-Duckham setting, and an "intermittent" vertical plant, with complete apparatus right through to deal with the gas made by any one system—the gas from the remaining two installations passing to the general works plant.

Mr. Smith was able to give the members the interesting fact that, over the year's working, the test works produce gas as cheaply as Birmingham as a whole, so the testing does not cost much.

The Laboratory.

In the laboratory, many of the visitors lingered; for there were displayed there hundreds of instruments and processes of use—or of necessity—to the gas-works chemist. Everywhere the laboratory provides evidence of a determination to secure accuracy, by the adoption of the best thought-out methods of doing so; and probably no one of a chemical turn of mind went away without a wrinkle or two. One thing even those who were not chemists could appreciate—a Junkers calorimeter, "made in Birmingham," and by the Gas Department, too.

A particularly interesting feature, which Mr. Smith afterwards told the members he would, had time permitted, have liked to have made them fully acquainted with, was the new arrangement for testing refractory materials for the annual contracts of the department. He said that he was one of those who believed that the standard specification for refractory materials was not any too satisfactory. There were many other details that required working out with still greater precision before it could be expected that contractors could work closely to the specification. For their laboratory they had designed a furnace which was in the form of an oven furnace, to take about sixteen samples of brick, 4½ inches long, for contraction or expansion tests, and in which it was possible to obtain an oxidizing atmosphere. There was nothing stated in the specification as to what atmosphere should be employed; but as the use of one atmosphere or the other meant a difference of over 1 per cent. in many cases, it was important that constant conditions should be specified, as the limit in the test was 1·25 per cent. For their arrangement, they used gas with air under pressure, and the burner designed by Mr. Roxburgh; and they were easily able to obtain, with a gas of 490 B.Th.U. net, a temperature of 1710° C.

Votes of Thanks.

After tea had been partaken of, Mr. S. A. Wikner (of Messrs J. Hardman, Limited, Birmingham) proposed, and Mr. Harold Jones (Stourbridge) seconded, a hearty vote of thanks to Captain R. S. Hilton, for his kindness in arranging the visit, to the Birmingham Corporation Gas Committee, for their hospitality as regarded the tea, to the Ministry of Munitions, for granting permission to inspect the toluol plant, and to Mr. Tomlinson and Mr. Smith and the members of their staffs, for the trouble they had taken in conducting them round the works.

Mr. Tomlinson promised that the vote should reach the proper quarters, and, with respect to himself, said the afternoon had been a pleasant and quite a useful one; for he had been able to look at the works from a different standpoint than when on his daily rounds.

Mr. Smith also acknowledged the vote, and said Birmingham was proud to be in the position to which he had drawn attention in his description of the toluol plant. It was a sort of "scrap" plant, to meet their own ideas of the requirements for gas-works purposes. Circumstances had not allowed them to put down anything of a more elaborate nature than was absolutely necessary. He had not given them much information as to the troubles experienced in toluol washing. This had been left to Mr. Rhead to deal with in his promised paper.

Work of the National Physical Laboratory.

The report issued some short time ago of the Privy Council Committee for Scientific and Industrial Research was referred to by Dr. R. T. Glazebrook, F.R.S. (Director of the National Physical Laboratory) in an address last week to the Birmingham and Midland Institute. This report, he said, has brought to the fore many of the problems that need solution, if we wish to place at the disposal of the nation all that science can contribute to the good of industry. He then proceeded to state his reasons for claiming that the National Physical Laboratory has assisted in the progress of the past ten or fifteen years, and that by its development there would be gained a powerful instrument to aid us in the future. The endowment of pure science is, it was argued, essential; without it the attempt to apply science to industry fails. The days are gone when successful manufacture could be carried on entirely by rule-of-thumb, trusting to the skill of some trained workman for the success of each delicate operation, when the hereditary instinct passed down from father to son was sufficient to produce each year practically the same results. New processes and products come which can be investigated in the works' laboratory; and all these investigations and tests must go on in the works themselves, under the eyes of men familiar with the process of manufacture in its every stage. Between the man of science research in the University and the works' chemist toiling in his shop, there is a gap. Means are needed to make the discoveries of science available to the manufacturer, to secure to him the advantages which come from the growth of knowledge. This is the function of a Laboratory of Industrial Research; and, among such laboratories, the National Physical Laboratory should hold a prominent place. The National Physical Laboratory has, however, another function to fulfil. It is a great standardizing and testing institution. If we are to have a National Industrial Research Laboratory, it should be supported by the nation, provided that a manufacturer who comes with a conundrum which he desires to have answered for his own benefit should pay. Giving an account of the laboratory, which was founded in 1899, Dr. Glazebrook said the Royal Society receives from the Government £7000 annually towards the cost. In the year before the war, the actual expenditure was nearly £41,000; and practically the whole of the difference between these sums had to be raised as payment for work done. The financial responsibility for the Laboratory rests on the Royal Society. In conclusion, he appealed for active support to make the National Physical Laboratory more efficient, more worthy of its name.

Coal Consumption in Germany.—Referring in a recent issue to prospective further economic restrictions in Germany, "The Times" said: "It is stated that the principal object is to reduce by every possible means the consumption of coal. The Government organs are careful to declare that there is no actual shortage of coal, but that it is necessary to save labour both in its production and its transport, and that it is especially desirable to relieve the railways. It is evident that there is to be a drastic restriction of railway travelling and a reduction of the tramway services, together with special measures to reduce the consumption of electricity. The use of artificial light for advertisement purposes of any kind is apparently to be forbidden altogether; shops are to be compelled to limit their lighting to absolute requirements; and the lighting of the streets is to be reduced. Shops, restaurants, and theatres are to close early. Economy in lighting and heating of private houses is to be demanded."

Sales of Gas in the United States.—According to the official report of the United States Geological Survey, the quantity of artificial gas—oil gas and water gas, and coal gas from retorts and bye-product coke-ovens—marketed in the year 1915 amounted to 266,204,248,000 cubic feet, valued at $173,832,132. These figures show an increase of 25 per cent. in quantity and 17 per cent. in value compared with 1912, the next preceding year for which the statistics of the industry were collected by the Geological Survey. The quantity of gas from coal-gas plants in 1915 was 43,747,432,000 cubic feet, valued at $40,257,108, an increase of 24 per cent. in quantity and 25 per cent. in value compared with 1912. The amount of water gas manufactured and sold in 1915 was 124,129,569,000 cubic feet—nearly as much as the combined output of coal gas from retorts and coke-ovens. The aggregate of oil gas and water gas sold in 1915 was 138,100,902,000 cubic feet, valued at $124,950,125, an increase when compared with 1912 of 13 per cent. in quantity and 12 per cent. in value. The average value of oil gas and water gas in 1915 was 90 c. per 1000 cubic feet, compared with 92c. for coal gas from retorts.

MODERN GAS EQUIPMENT FOR RESIDENCE LIGHTING.

Among the papers noticed in the last number to hand of the "Transactions of the American Illuminating Engineering Society" is one (in abstract) by Mr. M. A. Combs, dealing with the question of modern residence lighting by gas.

The author pointed out that the progress in gas lighting the last few years has been very great in all branches of lighting; but particularly marked is the development of residence lighting within the past year or so. Co-operation between fixture and burner and lamp manufacturers has resulted in improved fixtures, with increased efficiency in the burner. As an example, the horizontal burner has made possible the successful application of gas to semi-indirect lighting—opening a large field where gas lighting has every opportunity to demonstrate its great advantage of economy. Other signs of recent progress are the development of new lighting units; the constant improvement in mantles; the tendency to use only diffusing shades; and the new silk shades for gas-lamps.

Lamps and Fixtures.

The latest units are:

1. A new inverted lamp.
2. A lamp with an upright burner and three inverted mantles.
3. The horizontal burner.

1. The new inverted lamp has an enamel stack finished in various colours, uses two sizes of mantles, and has a single chain control, with improved pilot features.

2. The upright unit, which has three small inverted mantles, is especially adaptable for use on old fixtures without affecting their symmetry. It has rag mantles made of artificial cellulous fibre which can withstand rough usage.

3. The horizontal burner, about which the semi-indirect fixture is built, gives high efficiency and long life to the mantles and glassware. It is made in a variety of sizes.

The lamps and burners in common use for home lighting are as follows:

Lamp.	Consumption.	Mean Spherical Candle Power.
Small upright mantle burner . .	1·6 ..	35
Upright burner, three small mantles	3·0 ..	70
Gallery burner, short mantle . .	3·7 ..	80
Gallery burner, long mantle . .	4·5 ..	100
Inverted lamp	2·0 .	50
Inverted lamp	2·5 ..	60
Four inverted lamps	3·75 ..	90
One-mantle, horizontal burner. .	1·5 to 2 5 ..	40 to 65
Two-mantle, horizontal burner. .	3·0 to 5·0 ..	75 to 110
Three-mantle, horizontal burner .	4·5 to 7·0 ..	115 to 160
Four-mantle, horizontal burner .	6·0 to 9·0 ..	150 to 200
Five-mantle, horizontal burner. .	7·5 to 11·0 ..	190 to 300

The range is from 35 to 300 mean spherical candle power, with consumptions of 1·6 to 11 cubic feet of gas per hour. All figures are for the mantles bare, or covered with clear glassware. The lamps and burners are all equipped with bye-passes for pilot ignition.

Briefly, there are four sizes of upright burners for direct lighting, ceiling fixtures, and wall brackets and portable lamps; three sizes of inverted lamps in common use, and a fourth and larger size which may be used; and five sizes of horizontal burners, each of which may be equipped with two sizes of mantles.

Ceiling fixtures and wall brackets for upright and inverted lights of high quality and great variety are to be obtained from all gas companies. Semi-indirect fixtures in all sizes, ranging from 10-inch to 30-inch bowls are supplied; and one form may be had having two, three, or four small bowls clustered around a central supporting stem.

Semi-indirect fixtures are especially adaptable for combination lighting, where mantles and bulbs may both be employed in the same bowl.

Local control is largely used in residence lighting, with pilot light and chain or key bye-pass cock. Successful distant or push button control is obtained by using a magnet valve with pilot light or some other ignition device. Several dependable magnet valves are to be had, which are all supplied with pilot bye-pass. Pilot ignition is in general use and has proved a most reliable gas lighting device.

A few samples of up-to-date lighting fixtures were exhibited and illustrated, and then illustrations of actual installations were shown, to give some idea of what is being accomplished by gas in good lighting throughout the home.

Conclusions.

In addition to the good appearance and practicability of gas for residence lighting, its advantages are:

Reliability.—No extended interruption of gas service has ever been known to occur.

Convenience.—Equal to any other type of illumination.

Colour.—Approximately white, which is the best base to start from, as any colour may be obtained by suitable shading. Low intrinsic brilliancy practically eliminates glare—especially so as the mantle is almost always protected by diffusing glassware.

The satisfactory service rendered by modern installations shows that gas lighting needs no champion but itself.

GAS INDUSTRY PROGRESS IN MASSACHUSETTS.

In the course of a reference to the annual returns for the year ended June 30, 1916, the "American Gas Light Journal" notices a general increase in the output and sales of gas and in the gross earnings, especially in the case of the larger undertakings, and selects nine of this class, excluding the Boston Consolidated, as examples for consideration in detail.

All the nine concerns show a satisfactory increase compared with the two previous years—Springfield taking the lead with nearly 11 per cent. The total production of gas was close on 7,500,000,000 cubic feet, showing an increase of 5·9 per cent. on 1914-5, and 8·6 on the year before, A large portion is assigned to new cooking and heating business, though the lighting department is considered to have more than maintained its position. The sales for public lighting show a small advance. Of the gas manufactured, 4,074,023,000 cubic feet, or more than half of the total, consisted of coal gas, which is remarkable, when the local prices current for gas oil are considered, and that the yard price for coke is low, compared with the cost of coal. The remainder is carburetted water gas; and the proportions are unequally divided. New Bedford sends out over two-thirds of the latter; and others a larger proportion than half. But in all cases a mixed gas is the rule. The unaccounted-for gas remained steady over the three years, at an average of 8·1 to 8·4 per cent.; but this figure is unduly inflated by including the Malden and Melrose Gas Company, which suffers under the disadvantage of having 25½ per cent. leakage. Eliminating this abnormal figure, the other eight average about 6 per cent.

Coal is in some instances used in connection with the carburetted water-gas process, both in the cupola and under the boilers, and in one case the cost of coal so disposed of is 20 per cent. above the price realized for coke. Apparently forced draught and steam blowers are in favour in Massachusetts, as only two works use breeze for raising steam, and one of these shows the lowest price for coke. The cupola consumption was 48,643 tons of coke and 5612 tons of coal. The consumption of coal and coke averaged 36·3 lbs. per 1000 cubic feet of gas produced. The total quantity of gas oil consumed was close on 12 million gallons, averaging slightly less than 3½ gallons per 1000 cubic feet. The average cost of the coal was $4 to $6, that of coke somewhat less, and that of oil 4 c. per gallon.

The consumption of coal in the retorts was about the same as in the previous year, and amounted to 350,108 tons. Five companies have been able to increase the yield of gas per ton of coal; the average for the whole being 11,700 cubic feet per ton, or 5·25 cubic feet per pound. The cost of the gas coal ranges from $3·66 to $4·93 per ton, and in some instances is less than that used in the carburetted gas houses. The retorted coal yielded 243,911 tons of coke and 4,813,674 gallons of tar; the average being 13·9 cwt. of coke and 13¾ gallons of tar per ton of coal carbonized. Seven companies made 1,114,256 gallons of water-gas tar, on a make of 2,738,356,000 cubic feet of gas, about 0·4 gallon per 1000 feet.

The prices realized for residuals in June last were: Coke, $3·25 to $7·75 per ton; coal tar, about 3 c. per gallon; water-gas tar, as a rule slightly less than coal tar, but in two cases greater; ammonical liquor is quoted at 7 to 8 c. per pound, which probably refers to the pure ammonia content.

Scottish Junior Gas Association (Western District).

There was a meeting of the Association on Saturday afternoon, when Mr. John A. C. Edmiston, of Motherwell, read a paper on the "Control of Gas Producers." In consequence, however, of delay, which is now unfortunately so prevalent in connection with postal affairs, neither the paper nor the report of the subsequent discussion was received in time for inclusion in this issue of the "Journal." Fuller notice of the meeting must therefore be held over until next week.

The Illuminating Engineering Society hold a meeting next Friday, at the Society of Arts rooms, John Street, Adelphi, when an account of events during the vacation, including some suggestions regarding war economies in lighting, will be given by Mr. L. Gaster, the Hon. Secretary.

The December issue of "A Thousand-and-One Uses for Gas" [published by the British Commercial Gas Association] is another special factory lighting number—the third of the series. The evils of "glare" are pointed out; and by means of photographs and letterpress, convincing proof is adduced of the ability of high-pressure gas to avoid any semblance of this undesirable condition of affairs.

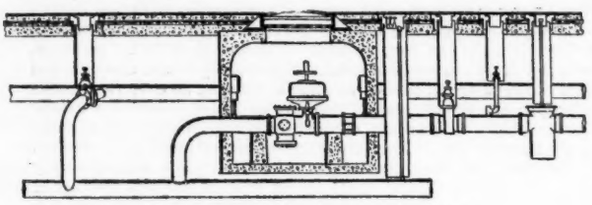
The United States Cast-Iron Pipe and Foundry Company have, says "Engineering," booked a contract with the Argentine Government for 66,000 tons of cast-iron pipe, at £13 5s. 6d. per ton. The largest pipes are 3 ft. 8 in. diameter. Shipments to Buenos Ayres will be commenced early next year. The contract is twice as large as one placed with a British company a few months since for Argentina—a contract that had to be declined by the American company as it was not then able to meet the delivery requirements insisted upon. The pipes now ordered are to be distributed among several Argentine municipalities.

HIGH-PRESSURE DISTRIBUTION AT SAN FRANCISCO,

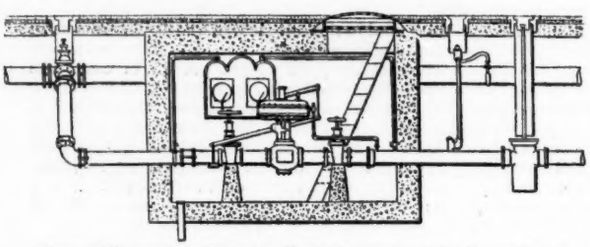
AND THE BEST FORM OF CHAMBER FOR DISTRICT REGULATION.

In describing the system of high-pressure distribution in use at Chicago, allusion was made to the use of underground chambers or vaults below the streets, for the accommodation of the district governors or regulators required to reduce the high pressure to ordinary distributing limits. A paper read by Mr. D. E. Keppelmann, the Distribution Superintendent to the Pacific Coast Gas and Electric Company, enables us to give some detail respecting a similar system as in use at San Francisco. The district of supply includes 32 vaults, in which are placed high-pressure reducing regulators of the upright type. Of these, the 3 in. by 4 in. and the 6 in. by 6 in. sizes are found to be the most satisfactory. Smaller sizes of the same make are occasionally used on services or house connections. All regulators or governors are repaired in the Company's shops, when necessary, and are tested and re-painted before being again put into use.

The duty of the regulators is to reduce the pressure in the feeding mains, from pounds per square inch, to inches of water in the consumers' or distributing mains. They are so located as to maintain an even pressure at all times, including the hours of heaviest or maximum consumption, and are each equipped with a complete arrangement of high and low pressure and bye-pass valves, drip boxes, and inlet and outlet recording pressure gauges. The whole system is inspected daily, the gauge charts renewed, and the used ones returned to the office, where they are tabulated and filed.



Round Pit with Pipe-Drip on the High Side.



Square Pit requires Twice as Much Concrete as the Newer Type.

The vaults have been constructed in two patterns, round and rectangular section respectively. The round pattern is 6 feet in diameter and 7 feet high, inside measurement; and the floor, wall, and roof are built of reinforced concrete of a uniform thickness—6 inches. The other is 10 ft. by 8 ft. by 6 ft. 6 in. high, with flat roof supported by railway metals, and the floor and walls of concrete, 9 inches thick. After several trials, reinforced concrete of 1-3-6 composition, with ¾-inch twisted steel rods, was adopted as the standard. The materials used in the building of a round pit of the older construction were 3 cubic yards of sand, 3½ cubic yards of rock, 20 sacks of cement, 132 feet run of ½-inch twisted steel rod, and a manhole frame and cover. The cost of the pit was $138; and the complete apparatus and fit up $662—making a total of $800. For a square section pit, the requirement was 18 cubic yards of rock, 6 cubic yards of sand, 91 sacks of cement, 100 feet run of railway metal, manhole frame and cover, &c., the cost of which was $497, and the fit up cost $704; making a total of $1201. The sand cost $2·25 per cubic yard, the rock $2·75, and the cement 60 c. per sack.

The round pattern was preferred as answering every requirement, while the cost was less than one-third of that of the rectangular shape, and the fixing of the appliances was easier and cheaper. The use of a drip box on the inlet of the governor was strongly recommended, as having an important bearing on the economy of repairs. All dust, grit, &c., were collected and prevented from accumulating in the governor, and the drip was fitted with a blow-off valve that would get rid of everything not too heavy to be lifted by the high pressure. All the valves and drip boxes are accessible from the road surface, being furnished with covering columns of cast iron and suitable removable cover plates. A 4-inch vent-pipe was carried from the highest point in the roof of the vault to the nearest lamp column or telegraph pole, and continued up to a height of 14 feet above ground level; the exposed portions being cased in 6-inch boarding. All the pits were standardized as to the fit up, and the valve seatings were so arranged as to admit of re-grinding when required. In connection with the pits there were 110 high-pressure and 165 low-pressure valves, all so placed as to enable the closing-down of a part of the system without crippling the remainder.

NAPHTHALENE TROUBLES.

By E. P. Vince, of Minehead.

[A Paper read before the Recent Meeting of the South-West Association of Gas Engineers.]

For several years deposits of naphthalene in the works' plant and district of the Minehead Gaslight and Coke Company have given much trouble. With the advent of tar-washing by the "C" process, the deposits were increased. This, I believe, is the experience of many other managers. We have succeeded in clearing our mains; and a short account of how this was accomplished may be of interest.

Experiments were first made with one of the advertised light hydrocarbon oils. The effect in our case was to drive the naphthalene from one point to another. We next tried spraying paraffin into a retort an hour before the charge was due to be drawn. This was done once every eight hours. As an alternative to spraying, we tried placing a can of oil inside the mouthpiece of the retort. The experiment proved a failure. Prior to taking over duties at Minehead, in July, 1915, in the course of my experience on three gas-works I had never seen or heard of a case of naphthalene stoppage. Carburetted water gas was made at all of the three works referred to. I believe it is generally accepted that oil gas acts as a solvent for naphthalene. As is well known, American gas oils are free from naphthalene, and Russian oils contain only traces.

In December, 1915, there appeared in the "Journal of Gas Lighting"* a description and illustration of the petroleum vaporizer invented by Mr. Thomas Glover, M.Inst.C.E., of Norwich, and made by Messrs. Parkinson and Cowan. My experience with carburetted water gas led me to think that the process promised well. The vaporizer is made in two types—steam heated and gas heated. We chose the latter, as our boiler pressure does not exceed 60 lbs. per square inch, and the heat would not be sufficient to crack-up the paraffin oils. For a description of the apparatus I must refer you to the article quoted.

The vaporizer was fixed in April last, and is capable of vaporizing 0·75 gallon per hour, with a gas consumption of 60 cubic feet. The flow of oil can be adjusted to any desired rate. The results at first were disappointing. The apparatus was put to work vaporizing 0·5 gallon per hour, and for three weeks matters seemed to get worse instead of better, especially in the outlying districts of Woodcombe and Alcombe. After this period complaints began to decrease, until they finally ceased. We now use the vaporizer one day per fortnight. The maximum demand for gas in Minehead is during the months of July, August, and September, when the town is full of visitors. This year, which was a record one for us as regards cooking load, there were three cases of naphthalene stoppage recorded; whereas during the corresponding period of 1915 the greater part of one man's time was taken up with blowing services.

The vaporizer can be fixed after the purifiers or station meter, or on the outlet of the governor as required. Care should be taken that it is well screened from draughts; and an improvement would be a lagging of non-conducting material. The inlet and outlet pipes should be sufficiently large to ensure a good stream of gas through the apparatus—this point is most important. The screwed joints from the outlet of the vaporizer should be painted with shellac dissolved in methylated spirits, or permac. Paraffin will get through ordinary painted joints. Some oils will be found in the first syphon after the apparatus. We get about 2½ gallons per 12 gallons of paraffin used.

Some of the many advantages of the vaporizer are as follows:

1.—The low cost of working after the mains are cleared. We find 3 gallons of oil per week sufficient. The cost of oil is 3s. 4·5d. The average quantity of gas sent out per week is 500,000 cubic feet.

2.—The increased delivering capacity of the mains and services when freed from naphthalene. This has been very marked in one district, where we used to get complaints daily. As to pressure, we never get complaints now.

3.—In case of accident, the gas can be treated quickly either with paraffin or benzol, &c.

* See Vol. CXXXII., p. 582.

Production of Pure Benzol.—In an address on bye-product recovery progress in the United States, delivered at the recent meeting of the American Gas Institute, Mr. C. J. Ramsburg said that, when the demand is for pure benzols of rigid requirements, a careful fractionation is made by the use of a highly efficient rectifying column and dephlegmator. It is possible to produce finished benzols of such narrow limits of boiling-points that they in this respect approach very closely the absolutely pure substances. At one Koppers benzol plant in the United States, both benzol and toluol have been produced commercially of so high a grade that 100 per cent. distilled within 1° C. (this range including the true boiling-point of the pure substance), and 95 per cent. of the product distilled within a range of 0·5° C. This extraordinary degree of purity is of great advantage to manufacturers of explosives and chemicals.

WEATHERING OF GAS COALS.

A FIVE-YEAR TEST.

By ALFRED H. WHITE, Professor of Chemical Engineering at the University of Michigan.

[A Paper read at the Annual Meeting of the Michigan, U.S.A., Gas Association.]

THE importance of a knowledge of the changes in gas coals exposed to the weather scarcely needs to be discussed. It may be illustrated, however, by the following hypothetical example. A gas company coking 100 tons of coal a day, desire to keep as a reserve stock 100 days' supply, or 10,000 tons. It costs this company 20 c. a ton more to take the coal from the reserve pile than to handle it directly from the cars. If this reserve must be worked over every year in order to have good coal, the added cost is $2000 a year. If it can safely be left for five years, the added cost due to handling will be only $400 a year.

The literature on the weathering of coals was reviewed a year ago by the Committee on Carbonization of the American Gas Institute; so that it is unnecessary to go over the ground here, except to quote their conclusion that there seemed to be no doubt that in foreign coals there was some deterioration due to weathering, but that in American coals exposure affected calorific value very little. No figures were available as to the effect of weathering on the yield and quality of gas, coke, tar, and ammonia.

The tests here described were the outcome of a discussion among a group of gas engineers at which the opinion was generally held that American gas coals did show marked deterioration if allowed to weather more than two years. The United States Bureau of Mines, who had previously co-operated with the Michigan Gas Association and the University of Michigan in testing coals from various portions of the country, co-operated also in this work. It is expected that, as in the previous instance, the Bureau of Mines will publish later a complete account of these tests, so that in the present paper merely a general description and summary of results is given.

The tests were conducted at the Gas Experiment Station maintained by the Michigan Gas Association, and by the Chemical Engineering Department of the University of Michigan at the works of the Washtenaw Gas Company, in Ann Arbor (Mich.). They were made under the direction of the writer, assisted by the various holders of the Michigan Gas Association Fellowships during the five years, and by a number of senior students in the course in Chemical Engineering. The work for the Bureau of Mines was under the direction of Dr. H. C. Porter. The coal was sampled at the mine, and loaded under the direction of engineers of the Bureau of Mines; and all chemical analyses were made at the Pittsburgh laboratory of the Bureau.

SOURCE, SAMPLING, AND STORAGE OF COAL.

Tests were made on a carload each of Pittsburgh and Fairmont gas coal. The Pittsburgh coal came from the Shoenberger Mine at Baird Station, Washington County, of the Pittsburgh and Westmoreland Coal Company. A carload of 21·5 tons net of ¾ inch screened coal was inspected and sampled at the mine on Nov. 1, 1910, for the Bureau of Mines. The Fairmont coal came from mine No. 63 (8) of the Consolidated Coal Company, in Monongah, Marion County, West Virginia. A carload of 29·5 tons net of ¾-inch screened coal was inspected and sampled at the mine on Dec. 10, 1910, for the Bureau of Mines.

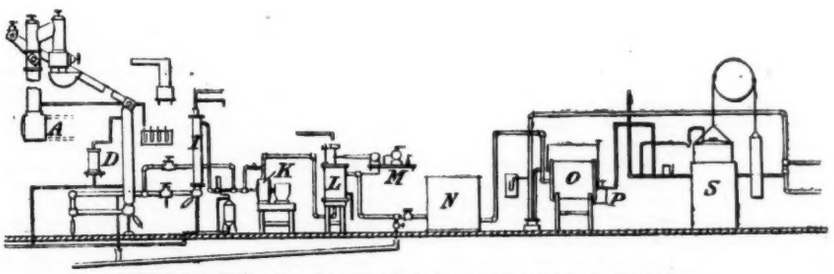
The 21·5 tons of Pittsburgh coal filled each compartment to a height of only 7 feet; and the partitions were therefore cut down to this height to allow fair weathering. The 29·5 tons of Fairmont coal filled each compartment about 9·5 feet. In order to determine whether there was spontaneous heating of the coal in storage, open gas-pipes for the reception of thermometers were laid horizontally in the coal at heights of 1, 4, and 7 feet above the ground, extending into the centre of the pile. No heating of the coal was detected.

The portion of about 3 tons of Pittsburgh coal or 4 tons of Fairmont coal which was thrown into the space in front of the bin when the cars were unloaded was carefully sampled. Most of it was put into sacks for the retort tests to be made on the fresh coal. But from each coal were filled two barrels and two heavy galvanized iron ash-cans. Two separate portions were subdivided and sampled for chemical analysis. The barrels were provided with perforated heads, and after filling were immersed in a storage basin fed with spring water which never froze. Each of the ash-cans held about 200 lbs. of coal. Their perforated bottoms were covered with wire gauze, and their tops were closed with a coarse screen which was locked shut. After filling they were air-dried, weighed, imbedded for about half their depth in the bin of coal, and left exposed to the weather. It was hoped that their change of weight would give an indication of the absolute change in weight of the coal due to weathering.

At the end of each weathering period, the coal of the proper compartment was sampled in two portions. The top 6 inches was removed as carefully as possible to the floored space in front of the bins, sampled, and sent to the Bureau of Mines for analysis. The coal thus removed from the surface was then replaced in the compartment; and the contents of the whole compartment were removed and sampled. Thus one sample was obtained representing the surface which had been most exposed to the weather, and another representing the average of the whole lot. The coal was, during the sampling process, systematically transferred into sacks, which were stored under cover and used for the retort tests. The coal in excess of that needed for the tests was thrown back into its compartment, for whatever later use might be desirable.

EQUIPMENT OF EXPERIMENTAL STATION.

The tests were all made in one of the top retorts of a bench holding six horizontal stop-end retorts. This bench was at the end of the battery; and a hole drilled through the end wall opposite the retort enabled the temperature of the outside of the retort to be observed with an optical pyrometer. The tests started in the fall of 1911, with a new single-piece clay retort which lasted for three years, and was then replaced by a sectional silica retort. The retorts were in regular use by the gas company, but could at any time by a system of valves be isolated from the regular works system and connected with the gas experimental station, which was a separate building of four rooms constructed as an annex to the retort-house, and immediately adjacent to the retort used for the test.



EXPERIMENTAL PLANT OF THE MICHIGAN GAS ASSOCIATION.

The bins for the storage of these coals were constructed at the plant of the Washtenaw Gas Company, and were made of wood with a board floor. At their back they adjoined the concrete wall supporting the elevated railroad track running into the plant. Each bin measured 11 ft. 6 in. along the front, 7 ft. 6 in. from front to back, and 10 ft. in height. It was divided into six compartments by board walls; each compartment being approximately 20 in. wide, 7 ft. 6 in. in length, and 10 ft. high, and closed at the front by short boards, so that the contents of any compartment could be emptied without disturbing the others. In front of each bin was an enclosed space with a wooden floor, to be used in sampling coal when emptying compartments. The cars of coal were placed at the works on the elevated track immediately behind the bins, and unloaded by hand; successive shovelsful being thrown into each of the six compartments, and a seventh into a coal-shoot running over the bins into the enclosed space in front. Thus each car of coal was cut into seven representative portions.

The arrangement of the experiment station during the last year of the test is shown in the accompanying diagram, from which it will be seen that the gas passes from the retort A through a jacketed condenser D, through which either hot or cold water can be circulated; then through an electrical tar precipitator I, a Sirocco blower K acting as an exhauster, an ammonia scrubber of the tower type L, an iron oxide purifier N, and a wet station-meter O. The gas for testing is sampled as it leaves the station-

meter by a dry meter P, which is geared directly to the main shaft of the station-meter, and acts as a pump which forces a proportional sample of the gas to a holder S, whose contents are thoroughly mixed by an electric fan before using. The tar and ammonia liquor are collected at various points in closed vessels; and the total condensate is weighed. The ammonia scrubber is fed with water through a rotating spray, driven by an electric motor; and the weak liquor is all collected and weighed. Since not all of the ammonia is removed in the scrubber, the gas is sampled at the scrubber-outlet; a portion bubbling continuously through standard acid and a wet meter M. The representative sample of purified gas in the proportional holder S was tested in the laboratory on the floor above. The equipment here consists of a Junkers calorimeter; a steel photometer bench 2500 mm. in length, with Lummer-Brodhun contrast photometer, Hefner light, and "London" argand burner; gas analysis apparatus; and a Schilling apparatus for taking the specific gravity of gases.

The condensing system as outlined here represents the latest development of the plant. During the first two years of the test, a mechanical tar separator of the perforated screen type was used, instead of the electrical separator; and the ammonia scrubber was of a less efficient type. Other minor changes were made from time to time to increase the accuracy of the work; but the general arrangement remained the same.

Method of Conducting Tests.

In order to keep as close a check as possible on all operating conditions, a large testing crew—usually consisting of five men—was employed. The amount of coal charged was usually 400 lbs.; and this amount of air-dried coal was weighed from the sacks into an empty charging car. Any lumps too large to be conveniently shovelled were broken with a hammer; but no other preparation was given the coal. The internal and external temperatures of the empty retort were taken with a Morse thermogauge, and the coal was thrown into the retort by two of the regular retort-house men. These men were uniformly willing to assist, and tried to put the coal in smoothly and evenly.

The suction in the condensing system was produced by a Sirocco blower running at 3600 revolutions per minute, and was controlled by one operator whose sole duty was to manipulate a throttle-valve in the line so as to keep the pressure in the retort as near zero as possible. The retort-pressure was registered on a recording gauge; and in addition readings were made every ten minutes of the various pressure gauges throughout the system, of the temperatures of the condensing system, and of the amount of gas made. The temperature at the inlet of the electrical precipitator was kept at 110° to 120° Fahr.; and in order to accomplish this, it was necessary to keep the condenser freely supplied with cold water in the early stages of the run, and to gradually change this to hot water as the rate of gas evolution decreased. The condensate in the various closed grips was collected at intervals, and poured into a closed tank. The test was continued until the yield of gas dropped off to about one-quarter of its average rate. The drop came quite sharply; and there was no difficulty in determining the proper time within ten minutes. The absolute duration of the test varied between four and five hours, depending on the temperature of the retort and the way the coal was piled in it.

When the test was over, the coke was drawn into a coke buggy, and at once weighed without quenching. It was then quenched, and held for later examination. Both internal and external temperatures were taken with the optical pyrometer after the coke was drawn. All the drips in the condensing system were then emptied, and the entire line from the stand-pipe to the iron oxide purifier was steamed out. The tar collected at the drips was added to that already collected; but the condensed water was thrown away. The tank of tar and ammonia liquor from the various drips was then weighed, and the ammoniacal liquor was decanted as cleanly as possible, and the tar weighed. The ammoniacal liquor was carefully mixed and sampled. The ammoniacal liquor from the scrubber was similarly weighed and sampled. The electric fan in the tank containing the proportional gas sample was allowed to run five minutes, to mix the contents of the tank thoroughly; and the gas was then tested for candle power, heating value, composition, and specific gravity. Chemical analysis was usually made only for carbon dioxide, illuminants, and oxygen; the percentage of oxygen being the information really desired. The samples of ammonia liquor were analyzed at the University laboratories.

Accuracy of Tests.

There are certain errors inevitable in tests like these. It is not possible to rake the retort perfectly clean before and after the tests; an undetermined amount of tar and coke sticks in the stand-pipe; and some gas is lost during the charging operation. There are, in addition, the errors due to defective equipment and manipulation. The most annoying instance of inadequate equipment was found in the platform scales set in the retort-house floor, and used for weighing the hot coke. An error of 5 lbs. on 270 lbs. was very possible with the scales. It was, however, quite an accidental, and not a systematic, variation, and became less important as results were averaged. All meters were carefully calibrated, and their water levels kept constant. The calorimetric and photometric apparatus was entirely adequate. The weight of coke, gas, tar, ammonia, and water was checked against the weight of coal charged into the retort. The average weight unaccounted for in this weight-balance was closely 1 per cent.; but individual tests sometimes showed a variation of as much as 4 per cent. in either direction. The amount of tar fluctuated considerably; the controlling factor most probably being the amount of water contained in it. No attempt was made to determine the amount of anhydrous tar.

The determination of the amount of ammonia is unsatisfactory; for the ammonia scrubber was never adequate to take out all the ammonia from the gas, and it was necessary to determine the ammonia in the gas leaving the scrubber by bubbling a portion of it through standard acid and an experimental meter. Though it seems that this procedure should have been reasonably accurate, the results varied unaccountably, even during the last year of the tests, when special attention was given to this phase of the subject. During this last year, the ammonia from the Pittsburgh coal varied from 3·99 to 5·01 lbs. per ton; and that from the Fairmont coal, from 3·49 to 4·86 lbs. It is known that the yield of ammonia is greatly affected by changes in retort conditions; but from the data at hand, we are entirely unable to account for this variation in the ammonia, and prefer to leave the figures entirely out of account.

Results of Tests of Pittsburgh Coal A. A. 15.

Summarized data are presented of tests on Pittsburgh coal exposed to the weather for six months, and one, two, three, four, and five years. It was intended to make tests also on the fresh coal but since the experiment station was not in readiness, the coals put in sacks when the car was unloaded had to remain stored under cover for nearly a year. The coal had been screened at the mine, and when received was mainly in lumps larger than 4 inches. After weathering five years, the top 6 inches of the bin contained much fine coal, and the lumps readily broke under the hammer. Though the physical appearance of the coal had changed after weathering for five years, no depreciation could with certainty be detected either by the retort tests or the chemical analyses.

Results of the retort tests as summarized in Table I. vary from one period to another, but not in a systematic manner; and the variations are probably due more to difference in retort conditions than to changes in the coal itself. For example, the low yield and high heating value of the gas in the unweathered coal is at least partly due to the fact that one of the two tests averaged was stopped before the gas was all evolved. When the one-year tests were made, it was not possible to get the retort up to a normal heat, so that the yield of gas for this period is small, but the candle power and the heating value are high. The fourth and fifth year tests were made in a silica retort, instead of one of fireclay; and possibly on this account the make of gas is higher than in any of the preceding years. These variables disappear somewhat if the product of the yield of gas by the candle power or the heating value is considered. The average candle-feet per pound of coal as charged is 82·6, with a maximum of 87·7 at the end of two years, and a minimum of 78·3 at the end of six months. The heating value in the gas from a pound of coal averages 3215 B.Th.U., and ranges from a minimum of 3013 after exposure to weather one year, when the retort temperatures were low, to a maximum of 3446 after exposure to the weather for five years, but when the tests were made in a silica retort. The weight of coke is fairly constant, with a maximum variation of only 1·6 per cent. from the average. No tests of the quality of the coke were made; but no deterioration could be noted visually, even when made from coal that had been weathered five years. Variations in the amount of tar are probably due more to its percentage of water than to any

Table I.—*Summary of Retort Tests on Pittsburgh Coal Exposed to the Weather.*

Duration of Weathering.	Number of Tests Averaged.	Products from 2000 lbs. Air-Dried Coal.				Quality of Gas.		Candle Feet per lb. Coal.	B.Th.U. in Gas per lb. Coal.
		Coke. Lbs.	Gas. Cubic Feet.	Tar. Lbs.	Ammonia. NH_3 Lbs.	Candle Power.†	Heating Value B.Th.U.		
0*	2	1371	9,700	155	4·4	16·6	661	80·6	3203
6 months.	5	1339	10,135	133	3·7	15·4	631	78·3	3197
1 year	5	1366	9,353	146	5·4	17·4	645	81·3	3013
2 years	3	1330	10,346	136	5·4	16·9	624	87·7	3217
3 years	6	1344	10,373	166	4·2	16·3	615	84·9	3188
4 years	6	1370	10,590	150	4·2	15·0	613	79·2	3240
5 years	6	1363	11,102	169	4·3	15·5	620	86·2	3446
Average	—	1355	10,228	151	4·5	16·2	630	82·6	3215

* Not exposed to weather after unloading from car, but stored in sacks under cover for nearly a year.
† Candle power determined in "London" argand burner.

other variable. The figures for ammonia are the least accurate of the series, as explained previously.

The changes in composition of the coal as revealed by chemical analysis should be much more closely concordant than those shown by the retort test, since the variables due to retort operation disappear, and the greatest error becomes that of sampling. The sampling was done with care; but a deviation of 1 per cent. from the average ash content is to be expected. A few proximate analyses showing the composition at the beginning and end of the test are given in Table II.

TABLE II.—*Proximate Analyses of Pittsburgh Coal.*
Referred to Air-Dried Basis.

—	Composite Mine Sample.	Car as Unloaded.	Average of Bin after Weathering 5 Years.	Top 6 in. of Bin after Weathering 5 Years.	Submerged in Water 4 Years 6 Months.
Moisture . . .	1·07	1·04	1·30	1·35	1·53
Volatile matter. .	34·55	..	34·90	34·98	35·75
Fixed carbon . .	58·51	..	57·33	57·49	56·30
Ash	5·87	6·01	6·47	6·18	6·42

The actual change in the coal substance can be followed better by eliminating the moisture and ash from the calculations. The analyses calculated to coal dry and free from ash are given in Table III. The agreement of the 25 analyses there tabulated

TABLE III.—*Analyses of Pittsburgh Coal. Computed to Dry and Ash-Free Basis.*

Condition of Coal.	Volatile Matter.	Fixed Carbon.	Sulphur.	Nitrogen.	Heating Value.
Mine sample (aver. of six)	37·13	62·87	1·15	1·52	15,289
Car as unloaded (aver. of four).	..	..	1·24	..	15,284
General Bin Sample—Depth of Coal 7 Feet.					
Weathered 6 mo. . .	..	..	1·06	..	15,380
,, 1 yr. . . .	37·49	62·51	1·03	..	15,390
,, 2 yrs. . . .	37·08	62·92	1·10	1·69	15,120
,, 3 yrs. . . .	37·65	62·35	1·10	..	15,156
,, 4 yrs. . . .	38·23	61·77	1·10	1·61	15,201
,, 5 yrs. . . .	37·84	62·15	1·20	1·70	15,170
Average . . .	37·66	62·34	1·13	1·63	15,245
Surface of Coal—Upper 6 Inches of Bin.					
Weathered 6 mo. . .	..	..	1·06	..	15,380
,, 1 yr. . . .	38·15	61·85	1·14	..	15,390
,, 2 yrs. . . .	36·73	63·27	1·15	..	15,160
,, 3 yrs. . . .	38·15	61·85	1·22	..	15,214
,, 4 yrs. . . .	38·12	61·88	1·16	..	15,192
,, 5 yrs. . . .	37·83	62·17	1·08	1·71	15,176
Average . . .	37·79	62·21	1·16	1·71	15,262
Coals Stored Under Water.					
Submerged 6 mo. . .	..	..	1·37	..	15,400
,, 1 yr. 6 mo. .	36·83	63·17	1·21	..	15,212
,, 2 yrs. 6 mo. .	38·53	61·47	1·39	..	15,192
,, 3 yrs. 6 mo. .	39·14	60·86	1·20	..	15,282
,, 4 yrs. 6 mo. .	38·57	61·43	1·16	..	15,298
Average . . .	38·27	61·73	1·27	..	15,277
Coals Stored in Open Cans Exposed to Weather.					
Weathered 6 mo. . .	..	..	1·16	..	15,400
,, 1 yr. . . .	37·74	62·26	1·06	..	15,331
,, 2 yrs. . . .	37·44	62·56	1·07	1·60	15,206
,, 3 yrs. . . .	37·31	62·59	1·11	..	15,217
,, 4 yrs. . . .	38·62	61·38	1·08	..	15,221
,, 5 yrs. . . .	38·19	61·81	1·20	..	15,223
Average . . .	37·86	62·14	1·11	1·60	15,266
Grand average .	37·87	62·13	1·17	1·68	15,261

is very close, and a testimony to the accuracy of the analytical work of the Bureau of Mines as well as of the stability of the coal. Rather unexpectedly, it is the coal stored under water which shows the only distinct change; its volatile matter increasing to a maximum of 2 per cent. over the mine sample. One of the most interesting criterions of the stability of the coal is seen in the constancy of its heating value when calculated to a moisture and ash-free basis. The greatest deviation from the mean of the 25 analyses is 0·92 per cent. If we take the average of the mine and car samples as the normal, we find that practically all the six-months and one-year samples are high by nearly the maximum amount of variation; while the two-year samples are without exception the lowest of the series. It would appear that such small variations as are present are the result rather of errors in sampling and analysis than of systematic change in the coal. A study of the ultimate analyses of the coal, as given in Table IV., confirms this impression.

TABLE IV.—*Ultimate Analyses of Pittsburgh Coal.—Calculated to Dry and Ash-Free Basis.*

—	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Sulphur.
Composite of six mine samples	5·41	85·44	1·52	6·48	1·15
Car as unloaded	5 54	85·35	1·68	6·41	1·02
Average of bin weathered four years	5·47	84 91	1·61	6·91	1·10
Top 6 inches of bin weathered five years.	5·46	84·94	1·71	6 81	1·08
Average of bin weathered five years	5·56	85·27	1·70	6 27	1·20
Submerged under water for four years six months . .	5 64	85·61	1 66	5·69	1·40

The variations in these analyses of coals stored in the air are almost all within the limits of error of analysis; and no systematic change can with certainty be shown. The coal submerged under water for 4½ years shows a slightly higher hydrogen and lower oxygen content than it had at the beginning of the test. The amount of coal thus submerged was not sufficient for retort tests, so that there is no evidence of the effect of this change in composition on the products formed in the retort.

The tests as to absolute change in weight of the coal exposed to the weather in screened galvanized iron cans were also negative. The analyses are given in Table III. The best check on the change in weight is afforded by the can which was not opened for five years. When it was first exposed to the weather, on Dec. 10, 1910, the net weight of the coal was 208·5 lbs., and the gross weight 239·0 lbs. On Jan. 20, 1916, after it had been exposed to the weather for five years, and again become air-dried under cover, its weight was 238·5 lbs.—an apparent loss of ½ lb. This is entirely insignificant, and within the limits of error, since the amount of moisture in the apparently air-dried lot might readily vary more than that. It can safely be said that whatever change there was, was small.

In summing up the results of these tests on the Pittsburgh coal, it can safely be said that, though the errors of testing are on the whole small, they are larger than the changes due to weathering. The conclusion is clear that this coal has not suffered materially after exposure to the weather for five years.

Results of Tests on Fairmont Coal.

The results of the tests on the Fairmont coal are very similar to those on the Pittsburgh coal. There was not quite so much physical change in the Fairmont coal; the lumps remaining firm and resistant to a hammer. The summarized retort tests on this coal are given in Table V. The various series of retort tests show less variation among themselves than those of the Pittsburgh coal, since there are five tests of Fairmont coal averaged in the initial series, against two for the same series with Pittsburgh coal; and the temperatures of the retort on the coal weathered one year are not abnormally low, as they were with Pittsburgh coal. The influence of the silica retort used in the fourth and fifth year tests is again evident in the higher make of gas in those years, so that the results from the gas standpoint are actually better with the weathered than with the unweathered coal. The average figure for candle-feet is 86·7, with the lowest figure 83·7 at the end of the six-months period, and the highest 89·1 at the close of the second year of weathering. The heat units in the gas from 1 lb. of coal average 3276; the low figures being 3175 at the end of two years, with the figures at the end of one

TABLE V.—*Summary of Tests on Fairmont Coal Exposed to the Weather.*

Duration of Weathering.	No. of Tests Averaged.	Products from 2000 lbs. Air-Dried Coal.				Quality of Gas.		Candle Feet per Lb. Coal.	B.Th.U. in Gas per Lb. Coal.
		Coke. Lbs.	Gas. Cubic Feet.	Tar. Lbs.	Ammonia. NH_3. Lbs.	Candle Power.†	Heating Value B.Th.U.		
0*	5	1347	9,906	136	4·7	17·5	645	86·6	3190
6 months . . .	3	1330	10,128	150	4 6	16·5	667	83·7	3368
1 year	5	1339	9,780	145	5·3	18·2	650	89·0	3180
2 years. . . .	4	1315	10,090	143	4·6	17·7	630	89·1	3175
3 years. . . .	6	1313	10,150	181	3·6	16 6	635	84·5	3221
4 years. . . .	6	1330	10,665	174	4·1	16·0	631	85·3	3370
5 years. . . .	7	1306	10,928	173	4·5	16·2	628	88 6	3428
Average . .	—	1326	10,235	157	4·5	16·9	641	86·7	3276

* Not exposed to weather after unloading from car, but stored in sacks under cover for nearly a year.
† Candle power determined in "London" argand burner.

year and for the unweathered coal a little higher. The high figure is 3428 B.Th.U. at the end of the fifth year.

These periods of maximum and minimum yields correspond almost exactly with those shown by the Pittsburgh coal. If the variations were systematic, they would strengthen the conclusion that it was a change in the coal which was making itself manifest. Since the results do not vary systematically, it is probable that the varying retort condition at one and another period are causing the maximum and minimum. No systematic variable in the results can be discovered which would indicate a change in the coal itself.

Proximate analyses of the coal at the beginning and end of the test are given in Table VI.

TABLE VI.—*Proximate Analyses of Fairmont Coal.—Referred to Air-Dried Basis.*

—	Composite Mine Sample.	Car as Unloaded.	Average of Bin after Weathering 5 years.	Top 6 in. of Bin after Weathering 5 years.	Submerged in Water 4 years 6 months.
Moisture . . .	1·47	1·25	1·50	1·30	1·63
Volatile matter . .	35·54	..	36·50	36·98	37·10
Fixed carbon . .	57·30	..	55·00	54·17	52·75
Ash	5·69	8·95	7·00	7·55	8·52

The actual change in coal substance can be followed best in Table VII., which gives the proximate analysis calculated to a basis of coal dry and free from ash. There is a distinct variation, noticeable also in Table VI., in the volatile matter of the mine sample and that of the samples which have been weathered one year; and it is unfortunate that, through a misunderstanding, no determinations of volatile matter were made on the samples sent in when the car was unloaded, and after the coal had been weathered six months. It is well known that coal changes somewhat rapidly during the first few weeks after its removal from the mine; and it is possible that this change accounts for the variation in the results. From the one-year to the five-year period, the volatile matter of the coals stored in the air shows little change. The coal stored under water shows an increase in volatile matter similar to that noted in the Pittsburgh coal. The heating value of the coal after storage for five

TABLE VII.—*Analysis of Fairmont Coal Computed to Dry and Ash-Free Basis.*

Condition of Coal.	Volatile Matter.	Fixed Carbon.	Sulphur.	Nitrogen.	Heating Value.
Mine sample (aver. of four)	38·28	61·72	0·73	1·51	15,158
Car as unloaded (aver. of four).	..	..	·93	..	15,185
General Bin Sample—Depth of Coal 9 Feet.					
Weathered 6 mo. . .	..	..	·72	..	15,400
,, 1 yr. . . .	40 86	59 14	·73	..	15,320
,, 2 yrs. . . .	39·60	60·40	·97	1·71	15,131
,, 3 yrs. . . .	39·63	60·37	·78	..	15,152
,, 4 yrs. . . .	39 85	60·15	·88	1·74	15,154
,, 5 yrs. . . .	39·90	60·10	·81	1·68	15,138
Average	39·97	60·03	·84	1·66	15,215
Surface of Coal—Upper 6 Inches of Bin.					
Weathered 6 mo. . .	..	..	·61	..	15,351
,, 1 yr.. . .	40·53	59·47	·93	..	15,300
,, 2 yrs. . .	39·40	60·60	·84	..	15,133
,, 3 yrs. . .	40·34	59·66	·82	..	15,203
,, 4 yrs. . .	40 05	59·95	·75	..	15,163
,, 5 yrs. . .	40·57	59·43	·68	1·75	15,070
Average . . .	40·18	59·82	·77	1·75	15,203
Coals Stored Under Water.					
Submerged 6 mo. . .	..	..	·75	..	15,350
,, 1 yr. 6 mo. .	39·60	60·40	·81	..	15,125
,, 2 yrs. 6 mo. .	40·90	59·10	·94	..	15,174
,, 3 yrs. 6 mo. .	41·40	58·60	1·09	..	15,232
,, 4 yrs. 6 mo. .	41·88	58 12	·91	.	15,237
Average	40·95	59·05	·90	..	15,224
Coals Stored in Open Cans Exposed to Weather.					
Stored 6 mo. . . .	..	..	·55	..	15,300
,, 1 yr. . . .	39·97	60 03	·80	..	15,221
,, 2 yrs. . . .	38·83	61·17	·91	1·71	15,136
,, 3 yrs. . . .	39·96	60·04	1·05	..	15,147
,, 4 yrs. . . .	38·84	61·16	·81	..	15,095
,, 5 yrs. . . .	39·64	60·36	·85	..	15,095
Average	39·45	60·56	·83	..	15,166
Grand average . .	40 06	59·94	·84	1 71	15,201

years is, as shown in Table VII., practically identical with that from the mine sample and from the car as unloaded. The heating value of the coal can be more accurately determined than the volatile matter; and since the heating value does not reflect the change from the mine sample indicated by the volatile matter, it is perhaps wiser to consider the change in composition as not proven.

The ultimate analyses as given in Table VIII. confirms the opinion that the weathering has caused no material change in the coal substance.

TABLE VIII.—*Ultimate Analyses of Fairmont Coal.*

Calculated to Dry and Ash-Free Basis.

—	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Sulphur.
Composite of four mine samples	5·47	85·17	1·51	7·12	0·73
Car as unloaded	5·49	84·35	1·63	7·57	0·96
Average of bin weathered four years	5·62	85·01	1·74	6·75	0·88
Top 6 inches of bin weathered five years . . .	5·74	84·95	1·75	6·88	0·68
Average of bin weathered five years	5·61	84·86	1·68	7·04	0·81
Submerged under water for 4 years 6 months . . .	5·68	84·84	1·73	6·86	0·89

The cans exposed to the weather for change in weight also fail to show any material change. The can of Fairmont coal when first exposed to the weather, on Dec. 10, 1910, contained 207·5 lbs. of air-dried coal, and had a gross weight of 237·5 lbs. On Jan. 20, 1916, after it had been exposed to the weather five years, and again become air-dried, its gross weight was 235·0 lbs., a loss in weight of 2·5 lbs., or 1·2 per cent. Even if this figure were absolutely significant, it would mean only a small change. When, however, it is considered that there was some loss of fine coal which sifted through the screens over the perforations in the bottom of the can, and that the possible difference in the moisture of the apparently air-dried coal at the beginning and end of the five-year period must also be considered, the apparent loss in weight is seen to be too small to be significant.

The conclusions to be drawn from the tests of the Fairmont coal, as of the Pittsburgh coal, are that no evidence of depreciation has been shown either by the retort tests or the laboratory tests.

The results side by side of the retort tests of the two coals after weathering for five years are given in Table IX.

TABLE IX.—*Results of Retort Tests of Coals Weathered Five Years.*

Kind of Coal.	Pittsburgh.	Fairmont.
Number of tests averaged.	6	7
Products from 2000 lbs. air-dried coal—		
Dry coke, lbs.	1,363	1,306
Gas, cubic feet	11,102	10,928
Tar, lbs.	169	173
Ammonia (NH_3) lbs.	4·3	4·5
Candle power of gas, "London" argand	15·5	16·2
Heating value, B.Th.U. per cubic foot.	620	628
Candle feet per lb. coal	86·2	88·6
B.Th.U. in gas per lb. coal	3,446	3,428

The final conclusion is that the changes in the coal were too small to be discovered by our present methods of testing and analysis. However much this may be regretted from the scientific standpoint, the practical result seems to be clearly evident—that gas coals of this type can be exposed to the weather in a rather severe climate for five years (provided they do not heat in storage), and at the end of the five years still be entirely satisfactory gas coals.

Tar Oils and Diesel Engines.—The Diesel engines at the electricity works of the Aylesbury Urban District Council, continue, the Electrical Engineer (Mr. W. A. Turnbull) reports, to run successfully on tar oil. The fuel costs per unit are now 0·51d. per unit, against 0·74d. when running exclusively on American oil. The trouble with the blocking-up of the pulverizers has practically been overcome by the fitting-up of three-way cocks to the paraffin oil tanks, and at intervals running on paraffin. At a meeting of the Council, it was explained that the necessity for cleaning the Diesel engines so frequently was not due to the use of tar oil; but it was advisable to clean certain parts every 300 hours, to get satisfactory results.

A Laboratory Gas-Meter.—The features of a new gas-meter for laboratory purposes have been explained by Dr. E. G. Beckett, of Ardeer, at a meeting of the Glasgow Section of the Society of Chemical Industry. He said that the device has been found useful for ascertaining the rate of a stream of gas in the laboratory; and it might possibly be helpful to laboratory operators generally. It is a syphon gas-meter, made entirely of glass; and it may be used for any gas which is slightly soluble in water or in other liquid employed. It is specially useful for highly corrosive gases—such as chlorine—for which the ordinary metallic gas-meter is out of the question. It had, he said, to be noted that, if a constant stream was desired, gas at a high pressure should be employed, and the rate regulated or throttled immediately in front of the meter. For gases very soluble in water, other solvents have to be used instead; but only mobile liquids can be employed. Hydrocarbon oil and sulphuric acid are found to be too viscous for the purpose.

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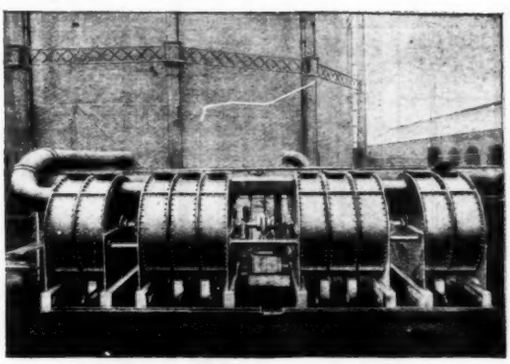
WHESSOE



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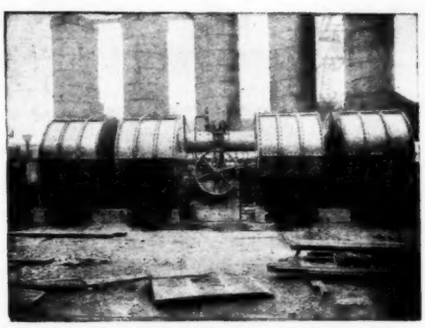

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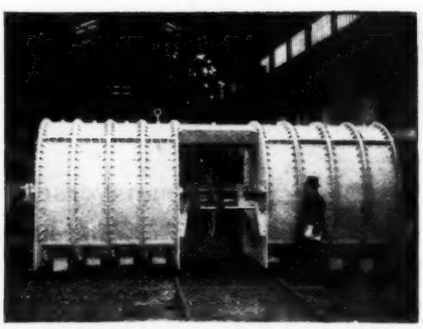

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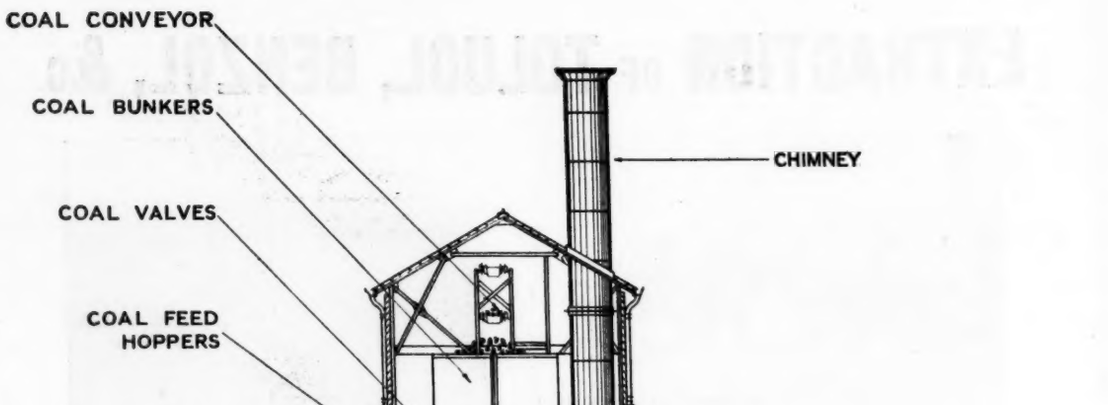
GLOVER-WEST VERTICAL RETORTS



Transverse Section of Retort-House for units of two retorts.

WEST'S GAS IMPROVEMENT CO., LTD.,

Engineers, Miles Platting, MANCHESTER.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

The members of the Eastern District of the Scottish Junior Gas Association paid a visit last Saturday to Galashiels, where they were shown over the gas-works by Mr. Francis Scott, the Manager.

The PRESIDENT (Mr. Jas. J. Scott) having thanked Mr. Scott for his kindness during the afternoon, and in entertaining the members to tea,

Mr. R. J. GAVIN read the following paper on

EXPERIENCES IN SULPHATE OF AMMONIA MAKING AT GALASHIELS.

Sulphate of ammonia, as you know, is a salt formed by the distillation of ammonia into sulphuric acid, and bearing the following formula: $(NH_4)2SO_4$. This would give a composition of 25·757 per cent. NH_3, and 74·243 per cent. H_2SO_4 in a perfectly pure salt entirely free from moisture. This condition of purity cannot be attained on a large scale; and we here have set our standard at 24·5 per cent. ammonia. As the following extract from the report of an Edinburgh analyst shows, we keep well up to the standard: Nitrogen 20·42 per cent. = ammonia 24·80 per cent. This sample was taken from a 10-ton lot sold by us on April 11 last. We regularly supply this quality, and occasionally sell quantities with a guarantee of 25 per cent. ammonia; but we find that the slightly higher price received does not compensate for the extra care in working, and especially in drying the sulphate. We have no centrifugal dryer; and the only way we can get our product dried is by placing it on the draining boards and allowing a draught of air to pass through the house by the open doors. We also turn the sulphate over periodically, because while the top portion may be dry, that below may be quite wet. The difficulty in getting our sulphate properly dried militates against our selling all our make with a guarantee of 25 per cent. ammonia.

Our plant was built in 1913, by Messrs. A. Gillespie and Sons, of Glasgow, and has never given us any trouble. It consists of the usual overhead liquor storage tanks (of 11 tons capacity) from which the liquor is run to the pre-heating chamber (heated by the waste gases from the saturator). The partly heated liquor then enters the top of the still, where the free ammonia is driven off by steam as it travels downwards to the liming-chamber, where the fixed ammonia is driven off by the action of the lime, and the ammonia gas travels upwards through the still and over to the saturator. The spent liquor and the condensation from the steam leave the bottom of the still by an overflow, which is kept open; so that in the event of the ammonia not being properly driven off in the still and liming chamber it is readily observed here and can be rectified. The ammonia gas is now blown into sulphuric acid, which is contained in the lead-lined saturator, and the ammonium sulphate is precipitated there, fished out with a scoop, and placed on the draining table, where the mother liquor is drained from the salt, runs into the well below, and is ultimately pumped back into the saturator. I have described the plant briefly, because most of you know all the details of such plant.

We find we obtain the best results by working acid of 144° Twaddel, and we always endeavour to supply liquor from the works at 5° Twaddel. If the strength falls below this figure, we get too much mother liquor; and if we get above the figure, we get a "slobby" salt. We always see that the mother liquor in the well stands at about 40° to 44° Twaddel, as when it is pumped back into the saturator at this strength we get clean white salt.

A word as regards "hogging-up." This is caused by hard ammonium sulphate crystals forming on the perforated ammonia gas inlet pipe to the saturator, and making a great deal of trouble in some plants. We avoid this by the simple expedient of blowing a jet of steam on the gas-coil before starting-up the plant and when the plant is finishing work for the night.

It is well-nigh impossible to say anything really new about sulphate of ammonia making; but I shall give a few of our experiences when testing the value of nitre cake in the making of sulphate, the use of which, in place of a percentage of sulphuric acid, is so strongly advocated by the Ministry of Munitions.

We purchased a small quantity of this nitre cake, or sodium hydrogen sulphate ($NaHSO_4$) as it is chemically termed, and, on analysis, found it contained about 30 per cent. free H_2SO_4. The nitre cake is readily soluble in its own weight of hot water; and we improvised a simple arrangement to get the nitre cake dissolved. We merely placed a wooden barrel close up to the saturator, and into it we led a ½-inch steam-pipe, by which we heated up the water and cake in the barrel. The nitre cake dissolved easily, and gave a solution testing 93° Twaddel at 60° Fahr.

I think that this method of dissolving—simple though it is—is as good as any, because it seems that in the process much of the nitric is driven off; and this at a place where it can do no damage. We used 84 lbs. of the nitre cake solution to 112 lbs. of sulphuric acid; the bath standing at 58° Twaddel. On working down to 56° Twaddel, we got a yield of 220 lbs. of sulphate. The following is the result of the analysis of the sulphate. It is as accurate as a single hurried test in the laboratory would permit. Ammonia, 23·59 per cent.; free acid, 0·78 per cent.; moisture, about 3 per cent. Although the ammonium content in this salt is rather lower, it might do as a commercial article in these times when sulphuric acid is so scarce.

We had an aqueous ammonia plant here three years ago, with which we turned out 0·940 ammonia; but we scrapped this plant in favour of the sulphate of ammonia plant, owing to the difficulty in finding a good local market for the liquid ammonia.

A brief description of the methods of manufacturing aqueous ammonia may be of interest. Instead of first distilling off the volatile or free ammonia and then treating with lime to decompose the non-volatile or fixed ammonia as in the manufacture of sulphate of ammonia, it is necessary in this case to add lime at the commencement of the process. This is done in a chamber; the liquor being constantly kept in motion by an agitator and thereby brought into intimate contact with the milk of lime. This prepared liquor is pumped to an overhead tank, and run from there, by gravitation, into the still. Continuous stills are also employed in this process, but combined with a cooler in order to get the ammonia gas as free as possible from aqueous vapour. This crude gas, however, contains pyridine bases and other volatile constituents of tar, as well as sulphuretted hydrogen. In order to eliminate the impurities, the gas is first passed through a simple lime washer and then through a small washer containing concentrated caustic soda in solution. The gas now passes into distilled water contained in a well-cooled saturator. Two saturators must always be employed, so that when the water in the one is nearly saturated the gas can at once be turned into the other.

In these times, the aqueous ammonia plant would be the better for us to have, because sulphuric acid for the manufacture of sulphate of ammonia is very difficult to get, owing to its being in so great demand for explosives. In peace times, however, we can find a better local market for sulphate of ammonia than for aqueous ammonia.

The PRESIDENT said it was difficult for anyone to follow figures and formulæ without having the paper in front of him. One of the first points in it that appeared to him to be worthy of mention was that Mr. Gavin stated that pure sulphate of ammonia consisted of 25·757 per cent. of ammonia and 74·243 per cent. of sulphuric acid free from moisture. He found he could not obtain this standard of purity on a large scale in practical working; and so they had to make their standard 24·5 per cent., though on tests submitted they occasionally gave 24·8 per cent. They might stretch a point, he thought, and make it 25 per cent., out and out, though if it were 24·9 per cent. the buyer would not object to pay on the 25 per cent. standard. The author made the nitre cake to the sulphuric acid in the proportion of 3 to 4, and obtained a yield of 23·59 per cent. The figures given would have been much enhanced if they had taken results right down to the make per ton of coal in pounds of sulphate of ammonia, and also if they had more details with regard to the working of the nitre cake. Professor Gray, before the Waverley Association in June,* read a paper on ammonia and tar distillates; and he would advise every member who had not a copy of the paper to get it. The information was such as would not be found in many text-books. The professor stated that the average coal content was 1·4 per cent. of nitrogen, which was equal to 148 lbs. of sulphate of ammonia per ton of coal—provided it could be obtained. This was impossible; the average yield worked out at between 20 and 30 lbs. There was a great field for developing the increased yield of sulphate of ammonia per ton of coal. The professor also gave further figures in connection with the distribution of nitrogen throughout the distillation of coal. M'Leod's tests gave an average of 17·1 per cent. recovered as ammonia, 1·25 per cent. as cyanogen, 3·9 per cent. as tar, and 19·5 per cent. free nitrogen in the gas; while there was 50 to 60 per cent. of nitrogen remaining in the coke. Apparently it would spoil the coke completely as a marketable article if they tried to obtain all the nitrogen out of it. In the Mond gas process, there had been a yield of 80 to 90 lbs. of sulphate of ammonia by treating coke; but what the coke was like he did not know. The whole paper dealt very fairly with the matter of obtaining ammonia; and the question appealed very much to the average gas manager in small works who had not yet put in a sulphate of ammonia plant, possibly because he had not made up his mind as to which was the best plant for him.

Mr. H. RULE (Kelty) said he was still debating as to the advisability of putting in a sulphate plant, and also what was the best plant for a works making from 28 to 30 million cubic feet of gas per annum. He had the idea that there were great possibilities in the direct-recovery process; and he was rather pleased to see a report by the Alkali Inspector in the Technical Press giving definite information as to some of the direct process plants at work. The only difficulty it appeared to him was with regard to the purification troubles. It seemed to be well enough established that the direct process so effectively took out the ammonia that the purifying material got into an acid state, and consequently did not do its work properly. Some works had got over this difficulty by bye-passing the plant to allow the ammonia to go forward, and so bring the oxide of iron into an alkaline condition; but this was a crude method of getting over the difficulty. Why should they try to get all the ammonia out of the coal and then deliberately bye-pass the plant to allow a proportion of the ammonia to go forward to rectify the purifying material? With regard to sulphate plant, he must be convinced that it was a paying speculation for his Company before he adopted it. His Company sold all their ammoniacal liquor; and he found that their average amount of liquor was about 45 gallons per ton of coal carbonized, and the average analysis was 1·36 per cent. free ammonia and 0·08 per

* See "JOURNAL," Vol. CXXXIV., pp. 646-650.

cent. fixed ammonia. He wished to emphasize, in dealing with this question so far as losing money was concerned, that if by careless working they lost ammonia equivalent to 1 lb. of sulphate per ton of coal, this represented, to a works of 30 million cubic feet per annum capacity, £24 a year. In works like those at Galashiels, this would amount to about £70. He would be glad if Mr. Gavin could give him some idea of the amount of fixed ammonia in his liquor. In small works the making of sulphate of ammonia was done by a trained or intelligent labourer, and he personally was convinced he would have difficulty in employing a man all the year round. This to some extent would increase the cost of manufacture, and therefore reduce the profits. He asked the author if he could tell him roughly what it cost to make a ton of sulphate on the average for the year. It would be well if they were to aim at a 25 per cent. standard, and to have the sulphate thoroughly dried and in a powdery condition, ready for the farmer to put on his fields.

Mr. C. HAMILTON (Loanhead) said that, like Mr. Rule, he had the idea they could get more out of sulphate plant than out of liquor just now. At the present time he obtained as much for tar and liquor as he would get for tar alone. He would like to know what the cost of making sulphate per ton ran to in Galashiels. Also could he get an idea of the cost of the plant?

Mr. R. B. CHALMERS (Falkirk) said he had experience of a successful home-made plant consisting of an old steam-boiler, with an open fire underneath. The boiler was filled seven-eighths full of ammoniacal liquor, and a fire was kindled. They had a good saturator which cost £70. Commercial caustic soda was pumped in by means of a hand-pump, instead of using milk of lime. The plant worked satisfactorily for a great number of years; and there was practically no depreciation. Eventually they installed a plant much the same as that at Galashiels, at a cost of about £500. This was for works with 28 to 30 million cubic feet of gas per annum capacity. In connection with the putting in of the milk of lime with a small hand-pump, it was found that the labour was not very satisfactory, because the men did not bother to work the pump unless some one was there to watch them. He got over this trouble by putting in a small steam injector, which worked automatically. From 10 o'clock at night till 6 o'clock in the morning the plant was under unskilled labour.

Mr. GAVIN, in reply, said that with regard to the President's remark that they should aim at 25 per cent. ammonium content in the sulphate, they had this object in mind; but before they could do so they would require a centrifugal drier. They had not large storage; and the continual turning over of the sulphate in order to dry it would take away the profit they would obtain from the higher percentage. The President had said that if they supplied sulphate at 24·9 per cent., instead of 25 per cent., buyers would not take exception to it; but this was not his experience. They once supplied sulphate at 24·9 per cent. when they guaranteed 25 per cent.; and they had to give a *pro ratâ* allowance for this. He thought that the nitre cake could be made all right. They required to use a less percentage of nitre cake in proportion to sulphuric acid in order to get a higher percentage of ammonia in the sulphate. In reply to Mr. Rule's question regarding the percentage of fixed ammonia, he had not got the figures with him; but he thought it would run to about 0·08 per cent. of fixed ammonia in ammoniacal liquor. They employed an experienced sulphate man who had had a chemical training in one of the large sulphate and tar-distilling works. With regard to the cost of making a ton of sulphate, he was sorry he had not the figures. He agreed with Mr. Rule's remarks regarding the necessity for pleasing their sulphate customers.

The proceedings closed with a vote of thanks to Mr. Gavin.

Manual of Electrical Undertakings and Directory.

A copy has been sent to us by the Electrical Press, Limited, of Nos. 13-16, Fisher Street, W.C., of the "Manual of Electrical Undertakings and Directory of Officials" for 1916-17. This is the twentieth annual volume of the series; and from the nature of the contents it follows that with the passing of time there is a tendency rather to increase than to decrease in the size of the volume. It has now reached 2000 pages, with fifty maps relating to different undertakings; and there is in addition the usual supplement in the shape of a large separate map of the United Kingdom, showing all the electric traction, light, and power undertakings, as well as another big map of the areas of electric supply undertakings in and around Greater London. Altogether, we are told, the "Manual" furnishes particulars with regard to 2650 electrical and allied concerns. Lighting, power, and traction, of course, form by far the largest of the five sections of the book; the directory of some 20,000 officials, with addresses, coming next. Among the special articles, there is noticed one dealing with the report of the Home Office Committee on the Lighting of Factories and Workshops. In its main features, as will have been gathered, the volume [the price of which is, as before, 21s. net] remains unchanged; the one unavoidable difference on the present occasion being delay in publication beyond the usual date—advantage of which has been taken to include accounts and other particulars to a later period than in earlier years.

Masonic.—The W.M. of the Northern Star Lodge, No. 3053, for the ensuing year is Bro. John Bond, of Southport, who succeeds W.Bro. E. J. Wellens, in the chair. The Treasurer (re-elected) is W.Bro. Walter Whatmough, of Heywood.

SPENT OXIDE IN AGRICULTURE.

Spent oxide appears to be generally regarded as a waste product in American gas-works. According to Mr. E. J. Murphey [whose paper treating of the "Removal of Sulphur from Spent Oxide," read before the American Gas Institute, appeared in the last issue of the "JOURNAL," p. 396], its usual destination is the waste heap. Mr. E. S. Jones, of the Pacific Coast Gas Association, states that the bulk of the oxide used in the United States, when spent, is a refuse material, and that the disposal of it is an expensive nuisance. Neither of the gentlemen named refers to the use of spent oxide in connection with the manufacture of sulphuric acid, although both have considered methods of extracting the bulk of the free sulphur that at the same time leave the residue fit for a second term of service in the purifier-house.

Mr. Jones said that in California large quantities of pure sulphur were used in the manufacture of a lime-sulphur preparation, employed for spraying fruit trees, and generally as an insecticide and germicide. The usual form in which this combination of lime and sulphur was supplied was as a reddish-brown liquid of 32° Beaume. An employee of the Pacific Coast Gas and Electric Company, who was also somewhat keen as an agriculturist, used considerable quantities of the preparation in his orchard, and suggested the possibility of employing spent oxide as the source of the sulphur content in the spray. The author was thus led to work out a series of experiments, which went to show that the idea was quite practicable and simple in operation; that the compound could be prepared in large quantities with economy; that the mixture prepared from spent oxide would compare favourably, in respect to efficiency and safety in use, with any other preparation of the kind now on the market; and that the spent oxide would be recovered in its original condition, and returned to the purifier-house in place of going to the waste heap.

A barrel of steel or wood was mounted in such a manner that it could be easily revolved for the purpose of agitating and mixing the contents. Both wet and dry steam were employed; the first being admitted by a run of perforated tubing carried along the lower part of the vessel, and the second by a coil. Spent oxide of known sulphur content was introduced in the proportion required to furnish 20 lbs. of sulphur per 50 gallons of completed mixture. Wet steam was turned on until 50 gallons of condensed water had accumulated; the mass being constantly stirred and agitated. The live steam was then shut off, and the mixture brought to a brisk boil by means of the steam-coil. Quicklime in the proportion of 15 lbs. to each 20 lbs. of sulphur was next added, and the heat evolved by the slaking of the lime assisted the reaction. The boiling was continued, and the mixture agitated for an hour, after which the liquid was drawn off through an iron wire screen, and diluted for use. The residue was simply turned out to dry.

The preparation was not only largely in demand as a germicide and insecticide for the garden and orchard, but as a sheep dip, as a cure for cattle mange, lice, and scurvy, when diluted with 15 parts of water, and in chicken ranches and barn-yards. The author expected to see his entire output of spent oxide handled at a good profit; the sulphur being sold in the preparation, and the residual oxide returned to the purifier-house as an active purifying material. There would be no surplus or waste.

INSTITUTION OF WATER ENGINEERS.

The Twenty-First Winter General Meeting of the Institution was held on Friday, at the Geological Society's Rooms, Burlington House, W. In the absence through indisposition of the President (Mr. F. W. M'Cullough, of Belfast), the Senior Vice-President, Mr. A. B. E. BLACKBURN (Sunderland), was in the chair.

ALTERATION OF THE ARTICLES OF ASSOCIATION.

Before the ordinary meeting, a special general meeting was held for the purpose of altering certain of the Articles of Association. The text of the changes was read by the Secretary (Mr. Percy Griffith); and they were briefly explained by the Chairman. He said the first one was to give a definite date by which the Secretary should receive notices of intending resignations of members. It had been found inconvenient to leave this matter as at present in a state of uncertainty. Therefore it was decided by the Council that a definite date should be fixed—viz., Dec. 1—on which any member desiring to resign could do so. The second alteration was as to the remission of subscriptions in war time. The Council had had under consideration several cases where, owing to the performance of war duties, members had been unable to continue their subscriptions; and the Council desired power to remit them. The third alteration was to relieve the President from the duty of being Chairman of all Committees and Sub-Committees of the Council. The fourth had reference to special meetings of the Council. The fifth was to reduce the quorum necessary at general meetings. The sixth was to reduce the number of members required to demand a ballot. The alterations were agreed to, on the motion of the Chairman, seconded by Mr. H. Ashton Hill (South Staffordshire Water-Works Company). A meeting to confirm the alterations will be held on Jan. 5.

The ordinary meeting was then held.

GENERAL BUSINESS.

The SECRETARY read the minutes of the summer meeting held on June 23; and these were confirmed.

Afterwards the accounts for 1915 were submitted, and formally adopted.

Messrs. J. W. Wilkinson (Resident Engineer of the Thirlmere Aqueduct) and Mr. G. G. Edwards were appointed Scrutineers of the balloting-papers.

On the motion of the CHAIRMAN, Messrs. Wood, Drew, and Co. were appointed Auditors; and Messrs. W. J. E. Binnie, B.A., and H. J. Rofe, M.A., were elected Hon. Auditors.

A TRANSFER, AND NEW ASSOCIATE MEMBERS.

Mr. B. E. F. Sheehy (Limerick) was transferred from the class of associate members to that of members; and Messrs. W. E. Orchards (Pembroke Docks) and H. W. Pearce (Swanage) were elected associate members.

PAPERS AND DISCUSSIONS.

Mr. W. J. E. BINNIE read a paper on the "Cross Hill Covered Service Reservoir for the Birkenhead Water-Works" and Mr. CHARLES CLIFTON submitted one on "The Rating of Water-Works." Both papers elicited good discussions.

OFFICE-BEARERS.

The Scrutineers reported the following elections as the result of their examination of the balloting-papers:

President: Mr. F. W. M'Cullough, of Belfast.
Vice-Presidents: Mr. A. B. E. Blackburn, of Sunderland; and Mr. C. H. Priestley, of Cardiff.
Ordinary Members of Council: Mr. F. J. Dixon, of Ashton-under-Lyne; Mr. H. C. Head, of Winchester; Mr. C. B. Newton, of Hull; Mr. H. Preston, of Grantham; Mr. C. H. Roberts, of Aberdeen; Mr. E. J. Silcock, of Leeds and Westminster; Mr. Harold W. Woodall, of Bournemouth; Mr. F. Storr, of Wrexham; Mr. F. W. Davies, of Nottingham; and Mr. A. E. Cornewall-Walker, of the East Surrey Water Company.

Votes of thanks were passed to the Geological Society for the use of their rooms, and to the authors of the papers. It was also agreed that a letter of sympathy should be sent to the President, with an expression of the members' hope that he would soon be restored to his usual good health.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Home Use of Sulphate of Ammonia.

SIR,—You will notice the correspondence which has been published in "The Times" concerning sulphate of ammonia.

I enclose copy of my last letter to that journal, which deals with the misleading statements made by Professor Somerville [see *ante*, p. 503].

D. MILNE WATSON,
Chairman, Sulphate of Ammonia Association.

84, *Horseferry Road, S.W., Dec.* 8, 1916.

[ENCLOSURE.]

To the Editor of "The Times."

Sir,—I hoped that my letter of the 27th of November [*ante*, p. 502] had sufficiently stated the point of view of the manufacturer of sulphate of ammonia; but as Professor Somerville has challenged some of my statements, I must ask your indulgence for a further letter.

This year's export figures given by the professor in no way conflict with my statement. I pointed out that manufacturers are quite prepared to sacrifice their export market if supplies are required at home; but that it is open to doubt whether it would be expedient for this country to export less than (say) 125,000 tons per annum under present circumstances.

The figures of sugar imports from Java given by Professor Somerville are entirely misleading because incomplete. This is a subject which does not lend itself to public discussion; but I am satisfied that I am correct in stating that from every point of view it is to the interest not only of the British Empire (including British India) but also of our Allies, France, Italy, and Japan, that as much sugar as possible should be grown in the Dutch East Indies at the present time.

The professor suggests that these countries should use nitrate of soda, instead of sulphate of ammonia. Exhaustive experiments, extending over a considerable number of years, have proved conclusively that nitrate of soda cannot be substituted for sulphate of ammonia in Java, owing to the nature of the soil and the heavy rainfall.

Practical experience does not bear out the professor's assertion that, weight for weight, the nitrogen in nitrate of soda is more valuable for all crops than the nitrogen in sulphate of ammonia; for there is far greater loss of nitrogen through drainage with applications of nitrate of soda than when sulphate of ammonia is used.

As regards prices, the statement contained in my last letter was quite accurate. It is true that a small quantity of sulphate of ammonia was sold during the autumn of 1915 at £14 10s. when the export price was about £16. Manufacturers agreed to accept this specially low price in order to encourage farmers to make an experiment with autumn dressings of wheat. It was not our fault that farmers did not avail themselves to a greater extent of the offer; and it would have been greatly to the benefit of this country had they done so, for the experiment has shown that, given suitable conditions, autumn application is extremely profitable.

Owing to the enormous increase in the cost of production, the price at which sulphate of ammonia was sold to farmers last spring was about £16 15s. per ton; and the average price for the whole of last season was in the neighbourhood of £16 10s. The price this season is, therefore, about £1 per ton cheaper.

In spite of the strenuous efforts made by the Board of Agriculture and manufacturers last season, the quantity of sulphate of ammonia sold was not so large as was expected; and it was with a view to offering further inducement to farmers to buy, so that the largest possible crops might be grown, that manufacturers agreed to a further reduction of price for this season.

The statement that overseas farmers are paying about £6 per ton more than British farmers for sulphate of ammonia is also perfectly correct; for at the present time the "delivered" price in many countries is about £21 to £23 per ton.

The question of home needs has been occupying the special attention of manufacturers ever since the middle of 1915; and we shall continue to see that sufficient supplies are provided as long as the manufacture of sulphate of ammonia in this country continues.

(Signed) D. MILNE WATSON, Chairman.
Dec. 5, 1916. Sulphate of Ammonia Association.

Ammonia and Steel Tubes.

SIR,—Recently through the installation at many gas-works of benzol-recovery plants, the question of ammonia attacking steel coils has come to the fore. It was mentioned by Mr. G. T. Purves in his instructive address recently delivered to the Scottish Junior Gas Association, and again in the article by Mr. D. Bagley published in the last issue of the "JOURNAL."

An interesting question arises with regard to this action of ammonia on steel, and that is, Why do makers of refrigerating plant use steel tubes, and not cast iron, and yet experience no trouble? Anhydrous ammonia is employed in most cases; but liquid ammonia is used in the absorption type of machine. Lately an absorption plant was taken down in London after sixteen years' work; and the steel tubes were found to be in very good condition. It would be very interesting if some of your readers who have been studying the question of the effect of ammonia on steel tubes could explain this contrary experience.

Dartford, Dec. 6, 1916. BERNARD P. BEZANT.

Benzol Recovery Plant.

SIR,—Mr. Bagley's article in your last issue on benzol recovery is interesting, when considered as a description of the apparatus made by his firm. The last paragraph, referring to patriotism and personal services, is, however, somewhat out of place in an article describing proprietary goods.

The working of benzol recovery plants on the scale described is so exceedingly profitable—especially as in so many cases it is subsidized and helped by the State, that the owners of such plant do not, I am sure, desire or expect any special merit of patriotism given them for their work.

Leeds, Dec. 9, 1916. H. W. SEYMOUR.

The Fatality at Aldershot.

A shunting fatality on the railway siding of the Aldershot Gas, Water, and General Lighting Company at Ash Road was recorded in last week's "JOURNAL;" it being stated that both the man killed and the driver of the engine had unavoidably been on duty for an exceptionally long spell, though the latter declared that this had not affected his ability to drive the engine. The Jury, however, thought fit to add to their verdict a rider which has been keenly felt by the Company's employees, who resent the suggestion that long hours entered into the question. In an editorial on the matter, the "Aldershot Gazette" says: There is not an employee of the Company who is not eye to eye and effort to effort with the General Manager (Mr. R. W. Edwards) in doing all that is humanly possible to meet the exceptionally heavy demands made upon them by the Ministry of Munitions; and there is no man, from the humblest labourer to the highest skilled mechanic holding the most responsible position, but what is ready to put his shoulder to the wheel, knowing full well that their interests are the first consideration of the Company. The co-partnership scheme has been in vogue for the past two years; and every man has a vested interest in the Company's great undertaking, realizing that the greater the success attained the larger the individual dividend they themselves will earn, quite apart from the question of wages or overtime addition. The Company were the first to inaugurate the co-partnership scheme in Aldershot, and by it they consolidated and emphasized the goodwill and loyalty of every member of the staff, indoor and outdoor. The death of a comrade undoubtedly gave every one of them cause for keen regret; but they recognized, and still recognize, that their friend died in the execution of duty well and faithfully performed, and that there was no cause for any outside or adverse criticism.

Output of Gas at Wigan.—Addressing the Wigan Town Council, on the minutes of the Gas Committee, Mr. Farr said they were getting the output of gas to a fairly normal figure again. In fact, the reduction was only about 3 per cent. compared with the corresponding period of last year. Unfortunately, however, every piece of fresh legislation seemed somehow to hit the gas-works. After surviving the curtailing of hours of licensed premises, getting over the loss of the street lighting, and so on, they were now faced with the Early Closing Act; and what the effect of this would be, they did not quite know. It certainly took off some of the hours when they ought to sell the largest quantity of gas. In Manchester and Birmingham, steps had been taken to demonstrate the capabilities of gas-furnaces; and it was intended to do something of the same kind at Wigan. Some of the small furnaces now procurable would be a godsend to many engineering works, such as they had in the Wigan district.

REGISTER OF PATENTS.

Producing Toluene and Benzene from Xylene and Cymene.

RITTMAN, W. F., of New York.

No. 13,100; Sept. 13, 1915. Convention date, July 7, 1915.

In his specification, the patentee remarks: It has previously been proposed to obtain benzol, toluol, and similar hydrocarbons from heavier hydrocarbons of the aromatic series by treatment in a glowing retort provided with an exhauster; while according to another process, the lighter hydrocarbons have been obtained by heating heavy hydrocarbons of the aromatic series to a dull red heat at a reduced pressure in the presence of a catalyzer.

The present invention, however, is distinguished from these prior processes by the fact that xylene and cymene constitute the substances treated for the production of benzene and toluene—the process consisting in subjecting them in gaseous condition to a temperature of not less than 400° C., at a pressure below atmospheric pressure; the reduced pressure being one of the essential conditions under which benzene and toluene are produced.

In the practice of the invention, the material to be treated—*i.e.*, xylene arcymene—is subjected to a temperature sufficiently high to effect complete gasification. The gases produced are subjected to a higher temperature, to effect a cracking of them, and to a pressure which will facilitate the formation of new hydrocarbons.

In the treatment of tars for the production of benzene and toluene, it is desirable that the gases should not only be subjected to a high temperature to effect the cracking, but also at a substantially high pressure—*i.e.*, 60 lbs. and higher—to facilitate the formation of new hydrocarbon combinations, such as benzene and toluene. In treating xylene and cymene, these high pressures cause the formation of an undesirably large percentage of carbon; and hence while the gases produced by heating the xylene and cymene, and other high homologues of the same aromatic series, to a temperature above their boiling points—*i.e.*, 220° to 225° C.—may be subjected to a pressure of 60 lbs. and upwards and a sufficient high temperature with good results as regards the production of benzene and toluene, in accordance with the invention now under consideration much lower pressures are employed. Practice has shown that the percentage of carbon produced decreases rapidly as the pressure is decreased. The best results —*i.e.*, high percentage of benzene and toluene, and small percentages of carbon—have been obtained by maintaining a pressure below one-half atmospheric absolute. It would seem that the retention of the cracked gases at a high temperature (as is necessary to obtain high pressures) affords an opportunity for a complete dissociation of a considerable portion of the gases and the consequent production of carbon; whereas when a pressure less than atmospheric is applied to the gases, there will occur not only a cracking due to the high temperature, but also a mechanical tearing apart of the gases. As this mechanical separation supplements the cracking action of high temperatures, the gases will not be subjected to high temperatures sufficiently long to permit of complete dissociation of more than a small quantity of the gases.

While any suitable temperature may be employed for effecting gasification of the material treated, the gases should be subjected to a temperature of 400° C. and upwards. In practice, it has been found that the best results have followed when employing a temperature between 600° and 850° C. By employing a temperature of about 800° C., and a pressure of half an atmosphere in treating pure xylene (C_8H_{10}) containing practically no toluene, above 30 per cent. yield of toluene has been obtained with less than 1 per cent. of carbon. But if the temperature be increased, and the same pressure be maintained, the yield of toluene is decreased, and that of benzene increased.

As an example of an oil treated according to this process, it may be mentioned that a quantity of xylene was cracked at a temperature of 750° C., and at a pressure of less than one atmosphere—being fed through the apparatus at a rate of 60 gallons per hour. The treatment resulted in the recovery of a mixture of benzene and toluene constituting about 60 per cent. of the volume of oil fed to the apparatus. When the mixture was distilled, the first cut up to 100° C. gave 2 per cent. of benzene, and the second cut at a temperature of 100° to 125° C. gave 34·5 per cent. of toluene.

Separating Suspended Impurities from Gases.

MOULSDALE, W. E., of Liverpool.

No. 14,806; Oct. 20, 1915.

This invention relates to a process for the separation of suspended impurities from gases or gaseous substances, so as to purify such substances by removing or separating from them "matter detrimental to the gases themselves or to living matter generally or detrimental to health, or to recover valuable substances."

The proposal is to effect the desired end by the employment of froth or foam contained in the apparatus, a form of which is described; froth or foam being produced by passing all or part of the gases or fumes to be cleaned into any froth-forming or foam-forming material, means being provided for subsequently breaking-down and separating the cleaned gas from the foam prior to the gas passing to the clean-gas main.

Furnace for Melting Metals.

DAVIS, H. N., and TWIGG, W. R., of Luton.

No. 16,110; Nov. 15, 1915.

According to this invention (applicable to furnaces heated by solid, liquid, or gaseous fuel), the metal to be melted is inserted into the furnace or crucible at a point below the surface of the molten metal already in it. For this purpose a tube of fire-clay or other material may be inserted into the furnace (its lower end being below the working level of the metal); and through the tube the metal to be melted is introduced, either continuously or intermittently, and by any suitable means.

Gas-Furnaces.—No. 101,077.

LEHMANN, J., of Bochum, Germany.

No. 6439; May 4, 1916. Convention date, July 30, 1915.

Uniform heating by gas of large furnaces offers difficulties, the patentee points out, as the gases (more particularly those rich in hydrogen—such as coke-furnace gases, which are valuable on account of their intense development of heat)—burn with a comparatively short flame, so that the heating effect of the flame decreases rapidly at a short distance from the mouth of the burner. But the present invention obviates this difficulty by introducing either the gas to be burnt, or the combustion air (or, in certain circumstances, both the gas and the combustion air) into one end of grooved channels in the inside of the furnace wall. The gas flows forward in the channel in spite of the latter being open to the furnace chamber, and a combustion of the gas takes place throughout the whole length of the furnace chamber, for the reason that a portion of the gas reaches the end of the channel as it would if the channel were an ordinary gas-burner.

Owing to the simplicity of such distribution of the gas, the invention is said to be applicable to many purposes—particularly for melting furnaces, where it has been hitherto impossible to use gases rich in hydrogen (for instance, pure coke-furnace gases) on account of the excessive shortness of the flame obtainable. It is essential that the gas should be introduced into the channels in such a manner as to prevent any air getting between the gas and the wall of the channel, otherwise the whole of the gas is at once carried into the eddy of the flames.

Gas Cookers and Boiling Rings.—No. 101,831.

LEGAT, A. S., of Coatbridge, N.B.

No. 4047; March 18, 1916.

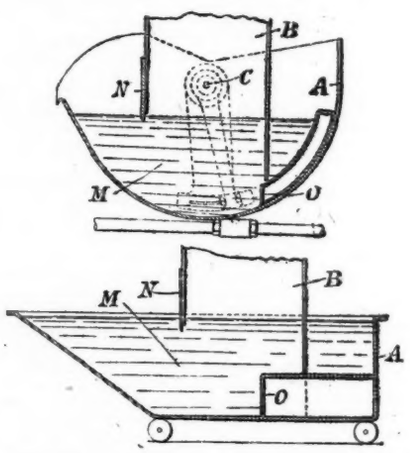
This fitting for gas cookers and boiling rings provides for the substitution of a combination of rings and bars for the straight or corrugated bars or for the rings and plates at present in use as grids or hot plates. The rings may be of a depth of 1¼ inches more or less, and about ⅛-inch thick, and of diameters to suit the sizes of vessels being heated—being so disposed as to surround the flame and allow free contact of the burning gas with the bottom of the vessel, clear of the bars or other obstruction. The fitting consists of a support with bars extending across it, and a ring or rings of circular, rectangular, or other configuration fitted to the bars, and having an "unobstructed inner periphery," serving to conserve the available heat energy and confine the application of heat to the vessel the contents of which are to be heated.

Discharging Apparatus for Vertical Retorts.—No. 102,093.

GLOVER, S., of St. Helens, and WEST, J., of Southport.

No. 3731; March 13, 1916.

This invention relates to vertical retort discharging apparatus through a water-seal by the oscillation or reciprocation of a trough or tray which in its movement in one direction effects the positive discharge of the coke from the open lower end of the retort or its extension.



Glover and West's Vertical Retort Coke Discharger.

Sectional end elevations of two arrangements of the apparatus are shown.

The trough A forms a water-sealed closure for the open lower end of the retort B, and is reciprocated or oscillated to effect the discharge of the coke in the known manner. The trough has a raised portion O extending from side to side of the trough and working beneath the open end of the retort, or it may be of just sufficient width to be capable of passing within the retort through a recess in one of the walls. The forward end of the raised portion acts as a stop to ensure that when the trough is being moved to withdraw coke from the re-

tort, it shall carry coke with it, and not be dependent upon the friction between the trough and the coke for the withdrawal.

The upper or top surface of the raised portion O may be shaped to correspond with the path through which the trough is moved—and thus prevent coke from falling behind the forward end. Thus, if the trough is reciprocated with a straight line motion, as in the second view, the top of the raised portion may be flat and in a plane parallel with the line of motion of the trough; while if the trough moves in an arc of a circle as first shown, where the trough is supported on trunnions C, the top surface may be shaped as a segment of a cylinder having its axis coincident with the axis of rotation of the trough.

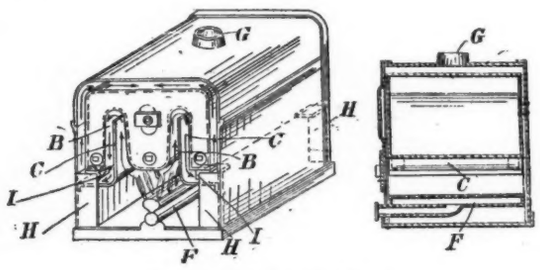
The lower end of the retort preferably has one side only cut away (as at M) to provide an opening, the amount of which may be adjusted by the sliding door N, through which the coke gains free access to the tray.

Gas-Heated Boiler.—No. 102,109.

POTTERTON, T., of Balham, S.W.

No. 6947; May 15, 1916.

This boiler, heated by gas, has in its bottom deep recesses substantially parallel to each other; and extending into each recess is a baffle-plate compelling the products of combustion from the gas jets to travel up one side of the recess and down the other. The passages thus provided for the hot gases terminate in a jacket surrounding the top and sides of the boiler and provided with a chimney.



Potterton's Gas-Heated Boiler.

A perspective view of the boiler without the front plate of the jacket or casing and a section on the longitudinal middle line are given.

The bottom of the boiler has two recesses B into each of which extends a plate C bent at a right angle and bolted to the inner face of the boiler jacket. The upper part is a separate piece, as indicated, so that it can easily be removed. The boiler shell in conjunction with the upper part provides the space for the flow of hot gases from the burner F to the flue G. To support the boiler, flanges H at the lower part of the ends of the jacket are bent horizontally at their upper ends to receive angle irons I bolted to the bottom of the boiler and serving as stops to maintain the space for the flow of hot gases.

Gas Cooking and Heating Plates.—No. 102,085.

SANDOW, E., of St. James Street, S.W.

No. 2799; Feb. 24, 1916.

This invention relates to a chamber to be placed upon the usual gas-ring or heating plate, and having openings in the top for placing pots, kettles, ovens, &c., with the object of confining and economizing the heat.

The appliance is formed as an entirely closed receptacle without means for the escape and loss of heat save for the openings for the pots or the like and a single opening at the bottom, beneath which one of the ordinary gas-rings of a stove may be brought, "such receptacle being adapted to extend beyond the area of a single burner." Around the opening, and depending from it, may be a flange or collar to collect and direct the flame and heat into the interior of the chamber; while in the construction of the chamber the sides may be brought lower than the bottom, so that they form a support for the chamber on the gas-plate and also provide a secondary chamber beneath the main chamber.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 6.]

Nos. 16,953—17,348.

BLAKEBOROUGH, R. A.—"Pressure regulating valves." No. 17,259.

BROADHEAD, J. B.—See Blakeborough. No. 17,259.

CORNELL, E. L.—"Instantaneous conversion of domestic fire-oven into gas-oven." No. 17,314.

DAY, A.—"Inverted mantles." No. 17,167.

FARTHING, J. H.—"Gas-heating apparatus." No. 17,048.

GILL, T. H.—"Joints for pipes." No. 17,165.

GILLIE, W. S.—"Combined gas-fire, hot-water circulator, and oven-heater." No. 17,037.

HAMILTON, W.—"Automatic mechanical gas-economizers for stoves, &c." No. 17,114.

KERSHAW, J.—"Furnace for treatment of spent oxide." No. 17,280.

RAILING, M. J.—See Farthing. No. 17,048.

SHAW, E. J.—"Inverted burners." No. 17,009.

WINSTANLEY, F.—See Farthing. No. 17,048.

LEGAL INTELLIGENCE.

Welsbach Company's Scheme in Court.

Mr. Clausen, K.C., last Tuesday appeared before Mr. Justice Younger in the petition of the Welsbach Light Company for the sanction of the Court to the scheme already outlined in the "JOURNAL" [*ante*, pp. 457, 499] for eliminating the German and Austrian interests. He pointed out that the scheme had been passed practically unanimously, only one £20 debenture stock holder voting against it. The application was under section 4, sub-section 3, of the Trading with the Enemy Act. Apart from such a section, it would be impossible to carry through an arrangement like this. His Lordship remarked that where there was a scheme involving the reduction of capital, they had to be careful that they did not prejudice other people. He did not think an Act passed through the House of Commons in about ten minutes was intended to drive out of other Acts all the safeguards of the creditors. Mr. Clausen replied that the keynote of this arrangement was that the Germans were disposing of shares which were no good to them for a consideration which the English shareholders did not value. On the face of it, it seemed such an extraordinarily good bargain for the British shareholders that one wondered why the Germans entered into it, until it was remembered that one of the terms was that the guarantee of the debenture stock by the German Company was put an end to. Of course, if the German Government did not give their approval, the whole scheme fell to the ground. After some further discussion, his Lordship made the order asked for.

Compensation Case at Exeter.

At the Exeter County Court on Monday of last week, Arthur Cecil Bates, of Fisher Square, St. Thomas, Exeter, sued Messrs. Willey and Co., under the Workmen's Compensation Act. The applicant was employed by the respondents in the meter-testing department, and on Aug. 24 last year his left hand was very badly crushed in an apparatus for pressing block-tin into shape for meter tops. He was a patient at the Royal Devon and Exeter Hospital for ten or eleven months, and all the fingers of his left hand were amputated. The accident had also affected his general health and nerves. Part wages were paid; and when the applicant was discharged from hospital he notified the respondents, who arranged for him to go to the works and undertake what was hoped to be suitable employment in connection with the repair of gas-meters. He was so terribly handicapped, however, that he had to give it up. An order of 10s. 6d. per week was asked for. Messrs. Willey and Co. claimed to treat well all their employees who were injured at the works. In this case, their view was that the applicant was fit for the light work which they could give him. At the suggestion of his Honour Judge Lush-Wilson, the parties came to terms; the respondents to pay 10s. 6d. per week up to date and 7s. 6d. in future, and costs.

East Grinstead and the Calorific Standard.

The East Grinstead Urban District Council have, on the report of the Gas Committee, agreed to instructions given the Clerk to notify the Board of Trade and the East Grinstead Gas and Water Company that the Council object to the granting of the Order applied for by the Company under the Gas (Standard of Calorific Power) Act, in the absence of the following conditions: (1) The imposition of a minimum pressure standard of not less than the pressure at which the gas is now supplied; (2) the imposition of 540 B.Th.U. gross, with a penal point of 500 B.Th.U. as the calorific power; (3) the apparatus to be used for calorific testing to be that mutually agreed by the Council and the Company, such apparatus to be capable of yielding, and to be used so as to yield, the total heat value of the gas in B.Th.U.; (4) that the apparatus for testing should be kept at the offices of the Council in the place already provided there for gas testing; (5) that the Order, if made, should be subject to review at the end of two years after the end of the war; (6) that as the gas now supplied by the Company is of less value to the consumer than that supplied before the war, which state of things is likely to continue in the future, the Company make a reasonable reduction in price. In moving the adoption of the report, Mr. Edward Steer said that he thought the Company were perfectly justified in applying for the Order; but it was the duty of the Council to safeguard the interests of the public. They were not acting in a spirit of antagonism to the Company.

Smethwick Gas Undertaking.—At a meeting of the Smethwick Town Council last Tuesday, the Gas Committee reported that, in view of the difficulties experienced in getting needful repairs and renewals carried out, they had decided to instal plant to enable them to effect their repairs and renewals at the gas-works with as little outside assistance as may be practicable. On the application of the Committee, the Ministry of Munitions have placed the department on the list of certified undertakings. The men in the employ of the Gas Committee, it was announced, will share in a general advance conceded for the period of the war of 2s. 6d. per week to all employees over 21 years of age.

Gas-Workers' Wages at Manchester.—Minutes of the Manchester Corporation Gas Committee confirmed at last Wednesday's meeting of the City Council contained the following item referring to the wages of gas-workers: "In accordance with the finding of the Committee on Production, the wages of machinemen, machinemen's assistants, furnace-fillers, pipe-openers, firemen, patchers, hopper-fillers, and coal-breaker men, also all other shift workers, and day workers engaged in the manufacture of gas, will be advanced 2s. 6d. per week as from the beginning of the first full-pay day in November, 1916." A similar resolution increases the wages of all men in the engineering and kindred trades by 3s. a week; and in accordance with an agreement arrived at between the Master Builders' Association and the Amalgamated Society and General Union of Carpenters and Joiners, the wages of all joiners in the Committee's employ are advanced 1d. per hour (from 11d. to 1s.).

MISCELLANEOUS NEWS.

INCREASED GAS PRICES IN BIRMINGHAM.

The Birmingham City Council, at their meeting last Tuesday, agreed without discussion to the recommendations of the Gas Committee to increase the charges for gas, in accordance with the scale appearing on p. 500 of last week's "JOURNAL." A proposal to increase the price of electricity current was also adopted—after criticism of the Electricity Department on the part of members.

Introducing the report of the Gas Committee, Alderman Sir Hallewell Rogers said he did not think anyone would be surprised that the Committee were compelled to raise the price of gas. The Council were aware of the increased cost of all materials; and this had particularly affected the Gas Department, both coal and gas oil being up in price—the latter alone accounting for an increase of approximately £60,000 a year. Then, at the beginning of the year, a war wage of 2s. per week was granted to the workpeople, and this, with the additional 2s. 6d. per week recently awarded, represented over twelve months an extra charge of approximately £25,000 on the department. At the same time, the income from tar and liquor had been considerably reduced, owing to lower market prices. The department was also affected by the Summer Time Act and the restricted lighting orders, both of which caused a reduced consumption of gas, particularly for domestic purposes, and thus decreased the income from customers paying the higher rates. The total output of gas, up to the present date, showed a slight increase over the corresponding period of last year; but the larger output was entirely on the lower rates for gas, which naturally reduced the average realized price. It became evident to the Committee that, unless the accounts for the year were to show a balance on the wrong side, the charges for gas must be increased at once; and after considering all the circumstances, they felt the rates now proposed were equitable. Manufacturers had been very generously treated in the past; and the Committee thought they should now be called upon to bear the biggest portion of the burden of increased charges. If the Council approved the scale recommended, the Committee anticipated being able to hand over to the rates at the end of March a similar sum to last year—about £26,000.

PROFITS AND THE RATES AT STOCKPORT.

There was a long discussion at last Wednesday's monthly meeting of the Stockport Town Council on a motion—"That, having regard to the present high rate of income-tax, and to the liability thereto of the profits of the trading departments of the Corporation, a Special Committee be appointed to review the basis on which the Gas, Electricity, and Tramways Committees respectively have hitherto made annual contributions out of their profits in aid of the rates, and to make such recommendations in regard thereto as they may consider desirable."

Mr. FERNS, in moving the resolution, said he was merely asking for inquiry. He did not intend to say anything which would lead in any way to prejudging the question, which could be more fully discussed when a report from the proposed Committee came before the Council. It might be thought inopportune to bring forward this question when the nation was at war; but it was necessary that they should go very carefully into financial affairs, because the most rigid economy would have to be exercised even after the war. He was not going to say that the profits of the commercial undertakings ought not in some measure to go in relief of rates; but he did think it should be considered whether the commercial undertakings should be run with the idea of relieving the rates or with the idea of supplying the commodities required by the town and putting the concerns in a good and prosperous position. The basis on which they had worked before had been the basis of expediency. He wanted to get away from this in the future, and work upon a sound commercial basis. The system as far as gas was concerned started in 1882; and he found that from that period up to the present £461,000 had been taken from the commercial undertakings of the Corporation in aid of the rates. During the last ten years, they had taken from the gas, tramways, and electricity profits in aid of the rates £251,000. Assuming that the amount taken in the next ten years was the same, and that the income-tax remained as now—and there was a possibility of it being higher—it would mean that over £62,000 would have to go to the Inland Revenue Commissioners, and the town would not benefit a penny so far as the money was concerned. There would, of course, be certain allowances; but the fact remained that a very substantial sum of money would have to be paid away. He noticed that prior to the war Local Government Board inspectors who were hearing applications for sanction to borrow for these undertakings had two or three times stated that the Local Government Board might at some time or other object to these loans, unless the profits were used to a greater extent for the needs of the works, and suggesting that providing for new machinery and certain other things should be met out of revenue. He had not brought the matter forward to "choke off" the aiding of the rates out of the commercial undertakings; but he thought they ought to consider whether the money could not be used to greater advantage.

Alderman GRAHAM, in seconding, said he had always felt that in producing a commodity for the benefit of the town the concern should devote the whole of its energy to doing this, without any consideration of profit at all. He hoped the Local Government Board would refuse to sanction further loans, unless only a fixed proportion was used for relieving the rates, and the balance for wiping off outstanding loans and the cost of new machinery and extensions, and so forth.

Mr. M'GREGOR remarked that ever since his connection with the Council they had pursued an unbroken policy in regard to the profit-earning departments; and this was that, after making certain provision for sinking fund and interest and other contingencies, the remainder of the profits should be handed over to relieve the rates. This was the policy that was continued to-day. It had the sanction of some of the leading business men who had taken part in the work of the Council. If there were any adequate reasons for making the change suggested, he would support an inquiry; but there were only two things they could do. They could hand over the profits, after making provision for depreciation and sinking fund and other contingencies, or they could cut down the price at which commodities from the undertakings were supplied to the public. The majority of the inhabitants belonged to the working classes; and there was only one undertaking from which the working man could hope to get a reduction. That was from the gas undertaking. The amount handed over last year from the gas department in aid of the rates was something like £10,000. With regard to income-tax, the 5s. in the pound was to help to pay for the war; and were they so unpatriotic as to think of getting out of their responsibility in this matter? It was their duty to use every endeavour to keep the rates down, so that large industrial concerns might be induced to come to the town and help in its development and prosperity.

Alderman HOPKINS said that at the present time Manchester was doing exactly the same thing as was suggested by the resolution.

Mr. T. W. POTTS remarked that it did not seem to him a high-minded action that they, as members of the Corporation, should attempt to escape their national obligations by an evasion of the payment of the income-tax. This appeared to him the only purpose why an inquiry was asked for; and it was not a good and sufficient reason.

Alderman SHARPLES said there were gas undertakings within a few miles of Stockport which were making 10 per cent. for the shareholders. If they got 10 per cent. in Stockport, it would mean something like £50,000 a year.

On a vote, 22 voted for the resolution, and 30 against.

RATES AND CHARGES IN VARIOUS TOWNS.

Annual Comparative Statistics.

The thirty-second annual statement with regard to the charges made for gas, electricity, and water, and profits and losses on municipal undertakings, together with the rates levied, in a number of Provincial towns and some of the Metropolitan boroughs for the year 1916-17, has been issued by Mr. W. Allison Davies, the successor to the late Mr. James Carter in the Borough Treasurership of Preston. There are on this occasion particulars given in connection with 136 places; the only fresh entry being Newark. Among towns that have previously supplied information, there are several blanks—of which depleted staffs no doubt provides more than adequate explanation.

That the tables are representative in the matter of size of the towns included, is manifest from the fact that the populations range from 895,678 in Birmingham to 13,000 at Clitheroe. With regard to rateable value, the highest figures shown are Westminster (£6,901,447), Liverpool (£5,047,302), Birmingham (£4,836,034), Manchester (£4,830,862), Kensington (£2,445,620), Leeds (£2,246,737), Sheffield (£2,075,408). The lowest are Clitheroe (£53,343), Mossley (£66,152), Newark (£72,061), King's Lynn (£86,518), Brighouse (£90,656), Haslingden (£90,938), Bacup (£91,000), Ilkeston (£91,432).

The places which are rated at 9s. or over in the pound are: Birmingham, 9s.; Leeds, 9s.; Rochdale, 9s.; Stockport, 9s.; West Bromwich, 9s.; Mossley, 9s. 1d.; Nelson, 9s. 2d.; Preston, 9s. 2d.; Chesterfield, 9s. 3d.; Colchester, 9s. 3d.; Harrogate, 9s. 4d.; Keighley, 9s. 4d.; Swansea, 9s. 4d.; Warrington, 9s. 4d.; Ashton-under-Lyne, 9s. 5d.; Colne, 9s. 6d.; Sheffield, 9s. 7½d.; Brighouse, 9s. 8d.; Rotherham, 9s. 8d.; Bacup, 9s. 9d.; Bradford, 9s. 9d.; Stalybridge, 9s. 9d.; Walsall, 9s. 9d.; Heywood, 9s. 10d.; Ilkeston, 10s.; Batley, 10s. 4d.; Halifax, 10s. 4d.; Lowestoft, 10s. 4d.; West Ham, 10s. 4d.; East Ham, 10s. 10d.; Norwich, 11s.; Merthyr Tydfil, 11s. 3d. The towns rated at 5s. or less in the pound are: Oxford, 4s. 5d.; Bournemouth, 4s. 11d.; Blackpool, 5s.

From the rents of property and profits transferred from municipal undertakings, &c., the rates are reduced in the following towns to the extent of 1s. or more in the pound: Halifax, 1s. 3½d.; Wallasey, 1s. 2¾d.; Liverpool, 1s. 2¼d.; Nottingham, 1s. 2d.; Stafford, 1s. 0¾d. At the other end of the scale, profits equal to only 1d. in the pound, or less, were contributed at: Croydon, ¼d.; Eccles (electric light and tramway profits to reserve), ¼d.; Heywood, ¼d.; Kingston-on-Thames, ¼d.; Middleton, ¼d.; Mossley, ¼d.; Bradford, ½d.; Brighton, ½d.; Eastbourne (tramway profits to reserve), ½d.; Hove, ½d.; Nuneaton, ½d.; Peterborough, ½d.; West Hartlepool (electric light and tramway profits to reserve), ½d.; Canterbury, ¾d.; St. Helens (gas, water, and electric light profits to reserve), ¾d.; Bacup, 1d.; Birkenhead, 1d.; Cheltenham, 1d.; Darwen (gas and water profits to the reserve), 1d.; Richmond (Surrey), 1d.; Rochdale, 1d. Among the 136 towns included in the list, there are about forty in which the rates were not reduced by profits from municipal undertakings; but in some of these cases there were such profits, which were carried to reserve.

In a number of the towns there were on certain municipal undertakings deficiencies which were met by an increase in the rates. There were, in fact, 68 cases of this kind—some of them, of course, relating to places in which other undertakings at the same time yielded profits that were utilized to reduce the rates. The two largest amounts are Birmingham (£113,186) and Preston (£47,750). In the former instance, the water supply was mainly responsible; while at Preston nearly the whole of the deficiency named was in respect of the docks. Two trifling losses on gas are indicated—at Liverpool, where the Corporation supply is now in the hands of the Company, there has been under municipal management a deficiency of £835; and at Nelson a loss is shown of £374. In the column setting forth the same information with regard to electric lighting, there are sixteen towns mentioned, the largest sums being involved at West Ham (£21,986), Hastings (£6275), and Lowestoft (£4000)—the last named being "due to special war conditions." In addition to Birmingham, there were waterworks losses of over £20,000 at Stockport (£28,428), Halifax (£25,877), and Swansea (£24,060). At Bacup, the rates had to make good a deficiency of £9255 incurred on the water undertaking—equivalent to

2s. 4d. in the pound on the rates. Meeting the deficiencies at Preston involved an increase in the rates of 2s. 2⅜d., at Heywood of 1s. 9d., at Harrogate of 1s. 6½d., at Stockton-on-Tees of 1s. 5d., at Lowestoft of 1s. 3d., at Halifax of 1s. 2d., at Stockport of 1s. 1¾d., at Middleton of 1s. 0⅛d.

One of the sections of the statistics has reference to the charges made for gas, water, and electricity in the various towns included by Mr. Davies. Taking first the case for gas, it is seen that there are two places in which the net charge per 1000 cubic feet for a domestic supply of gas for lighting purposes is 4s. or more. At Lowestoft, the figure is 4s. 5d.; and at Swindon, it is 4s. Since the last issue of the return twelve months ago, there have, of course, been various alterations in an upward direction; but Widnes retains its premier position in the matter of cheapness, with an unaltered price of 1s. 3d. per 1000 cubic feet, with lower charges for large consumers, engines, &c. The other towns in the table in which the price of gas for domestic lighting is 2s. or less per 1000 cubic feet are: Sheffield, 1s. 9d.; Sunderland, 1s 9d.; Bath, 2s.; Belfast, 2s.; Newcastle-on-Tyne, 2s.

In the matter of electricity, the charge per Board of Trade unit for domestic supplies ranges from 7½d. at Chatham, 7d. (flat-rate) at Bromley, 7d. (average charge) at Hastings, 7d. at Hove, 6½d. (flat-rate) at Kingston-on-Thames, 6½d. at Leamington, 6d. at Bournemouth, and 6d. at Lincoln, down to 2½d. at Reading, 3d. at Ashton-under-Lyne, 3d. at Bury, Lancs., 3d. at Hammersmith, and 3d. (average charge) at Southampton.

The charge for water for domestic purposes on a house of £15 rateable value is over 2s. in the pound in the cases of: Middleton, 2s. 6d.; Lincoln, 2s. 4d.; Leicester, 2s. 1d. The rate is 2s. in the pound at Bacup, Birmingham, Bury, Harrogate, Haslingden, Heywood, Huddersfield, Leigh, Rawtenstall, Rochdale, and Rotherham. The charges are lowest in: Canterbury, 5d.; Liverpool, 5½d.; Southampton, 6d.; King's Lynn, 6½d.; Worcester, 8d.; Worthing, 8½d.; Brighton, 9d.; Hove, 9d.; Leamington, 9d.; Manchester, 9d. Other towns in which the charge is less than 1s. in the pound are: Bootle, Bournemouth, Crewe, Gloucester, Oxford, Peterborough, Plymouth, Reading, Richmond (Surrey), Widnes, and York.

In the case of Preston itself, the rates are, as already remarked, 9s. 2d. in the pound. Out of receipts from municipal undertakings. the rate sare relieved to the extent of 5½d. in the pound; but, on the other hand, deficiencies on the water and dock undertakings have resulted in the rates being increased by a sum of 2s. 2⅜d. in the pound. The price of gas at Preston for domestic lighting is 3s. per 1000 cubic feet; of electricity, 5d. per unit; and of water, 1s. 6d. in the pound on houses of £15 rateable value.

INCOME-TAX REFUNDS.

In sending out to the shareholders the report for the year ended Sept. 30 of the Chapel, Whaley, and District Gas Company, the Secretary (Mr. Robert Hall) enclosed the following useful statement for the guidance of the shareholders.

INCOME-TAX.

Present Rate, 5s. in the Pound.

As you are aware, this is now a very serious item; and I append a table from which shareholders will be able to see how they stand in regard to the return of tax they are entitled to receive from the Inland Revenue by way of repayment, according to the amount of their annual income.

1.—Those whose income is under £130 per annum, will be allowed a return of the tax on their income up to £120 per annum.
2.—Those whose income is over £130 and under £500 per annum, will be entitled to a reduction of 2s. in the pound on their unearned income.
3.—Those who exceed £500 per annum and not over £1000, are entitled to a reduction of 1s. 6d. in the pound.
4.—Those who exceed £1000 per annnm and not £1500, are entitled to a reduction of 1s. in the pound.
5.—Those who exceed £1500 per annum and not over £2000, are entitled to a reduction of 6d. in the pound.

A certificate showing the amount of the income-tax deducted from your dividend is attached to the dividend warrant. Forms for claiming repayment may be obtained from the Surveyor of Taxes..

Ripon Electricity Scheme Held-Up.—The Ripon City Council some weeks ago decided to apply for a Provisional Order for the supply of electricity. The necessary formalities were observed, the application was advertised, and two-thirds of the cost of obtaining the Order incurred, when the Corporation received a communication from the Local Government Board stating that the representations made by the Council did not disclose any special circumstances which would justify the Board in holding that a *primâ facie* case existed for the promotion of a Provisional Order at the present time. The Chairman of the Electricity Committee interviewed the officials; but the only result was a further letter from the Board declining to alter their decision. The Council are urging the Board to reconsider the matter.

Supervision of Accident Claims at Manchester.—The question of the more effective supervision of claims for accidents under the Workmen's Compensation Act has for several months been engaging the attention of a Special Sub-Committee of the Manchester City Council. Hitherto it has been the practice for the departments concerned to generally supervise the accident claims arising in their respective sections; but the Committee say it is considered desirable, in the interests of the Corporation, and also those of the injured workmen or their dependants, that the entire supervision of accident claims shall be entrusted to the Town Clerk's department, and that from the time of the accident until the return to work of the men the settlement of the payment of compensation, or the award under arbitration proceedings relating to such cases, shall be dealt with by this department. The Chairman of the Gas Committee (Alderman W. Kay, J.P.) has intimated the willingness of his Committee to pay a further sum of £250 per annum towards the cost of carrying into effect the proposed scheme, which has been recommended to the Council for adoption.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

The Government Department.

In connection with the proceedings reported last week [p. 501], when the deputation from the Board of Scientific Societies waited upon Lord Crewe (as Lord President of the Privy Council and President of the Committee of the Privy Council on Scientific and Industrial Research), to urge the need of financial assistance from the Government, it may now be added that the following official announcement was subsequently made.

The Government have decided to establish a separate Department of Scientific and Industrial Research for Great Britain and Ireland, under the Lord President of the Council, with the President of the Board of Education as Vice-President. They have also decided, subject to the consent of Parliament, to place a large sum of money at the disposal of the new Department, to be used as a fund for the conduct of research for the benefit of the national industries on a co-operative basis.

The Board of Inland Revenue have decided, with the approval of the Chancellor of the Exchequer, that no objection shall be offered by their Surveyors of Taxes to the allowance, as a working expense for income-tax purposes, of contributions by traders to Industrial Associations which may be formed for the sole purpose of scientific research for the benefit of the various trades; and the allowance would be equally applicable as regards traders' contributions specifically earmarked to the sole purposes of the research section of an adapted existing Association. In both cases the allowance would be subject to certain conditions—*e.g.*, the Association or the research section to be under Government supervision, and the trader's contribution to be an out-and-out payment, made from his trade profits, and giving him no proprietary interest in the property of the Association, &c.

In order to enable the Department to hold the new fund and any other money or property for research purposes, a Royal Charter has been granted to the official members of the Committee of the Privy Council for Scientific and Industrial Research, under the title of the "Imperial Trust for the Encouragement of Scientific and Industrial Research." The Trust is empowered "to accept, hold, and dispose of money or other personal property in furtherance of the objects for which it has been established, including sums voted by Parliament to that end." The Trust can take and hold land, and can "accept any trusts, whether subject to special conditions or not, in furtherance of the said objects."

A substantial gift has already been made to the Trust by two members of the Institution of Mechanical Engineers for the conduct of a research in mechanical engineering to be approved by the Department, in the hope that this example will be followed by other members of the Institution.

Mr. H. Frank Heath, C.B., has been appointed Permanent Secretary of the new Department.

THE COAL-TAR COLOUR INDUSTRY.

Before the Royal Society of Arts last Wednesday, Mr. C. M. Whittaker, of British Dyes Limited, read a paper on "The Coal-Tar Colour Industry." For the most part it was a repetition of his previous papers before the Chemical Society at Edinburgh and the British Association at Newcastle this year. Referring to these latter, he recalled the fact that on each occasion he had been assailed in certain quarters for not answering criticisms passed on British Dyes Limited. Therefore he wished to make it perfectly clear at the outset that he did not appear as an apologist for British Dyes Limited, but merely by the invitation of the Society to give a lecture on a subject with which he had been intimately connected for some seventeen years. While willing to answer any points that might arise on the paper, he must refuse to answer any questions on the policy of British Dyes Limited.

The paper recounted the history of the coal-tar colour industry, and what had been done by British firms to supply the Government and our allies with dyes on the outbreak of war when all our foreign supplies had been cut off. Dealing with the difficulties the trade is now suffering from—it being possible practically to supply only Government needs—Mr. Whittaker pointed out that the two high explosives most largely in use are picric acid and trinitrotoluol. The latter requires similar apparatus to that which is used for making compounds like nitro-benzol, so essential in coal-tar colour manufacture. The engineering trade had been so much occupied in connection with the supply of munitions that it has been difficult to get delivery of the plant for necessary extensions. For the same reason there had been a shortage of the skilled labour necessary for the erection of the plant and the requisite buildings. The increases in the prices of copper and lead had also added enormously to the cost of the plant. Again, the life blood of the coal-tar colour industry is sulphuric acid, fuming sulphuric acid, and nitric acid—all indispensable for the manufacture of high explosives. In this fact was the greatest handicap of the British coal-tar colour industry at present, because, as was known to every acid consumer, the supply of acids was nothing like equal to the demand.

Among the raw and primary products of the industry, the four most important were benzol, toluol, naphthalene, and anthracene. The distribution of toluol was, of course, controlled by the Government; the reason for this control being that the amount to be distilled from coal tar had very definite limits, which were relatively small. Benzol was the starting point for the manufacture of synthetic carbolic acid, of which so much is being made now owing to the demand for outstripping the production of carbolic acid distilled from coal tar. This was being used for picric acid. Naphthalene and anthracene were free markets; but the control of one of the chief primary products was a heavy initial handicap on the output of coal-tar products at present.

Discussion.

Sir WILLIAM TILDEN, F.R.S., who was in the chair, said all our troubles in connection with the coal-tar colour industry rose from the

fact that neither Oxford nor Cambridge had cultivated the study of organic chemistry.

Dr. M. O. FOSTER said that, leaving out Germany, the British colour industry before the war was well ahead of any other country in the world except Switzerland. France had a colour industry; but it was really an intermediate assembling industry—the intermediates being imported from Germany. The same applied to the United States. The whole difficulty in this country was that we did not make enough intermediates. At the same time there was a substantial intermediate manufacture in this country before the war; and in this respect we were ahead of all other countries except Switzerland. It was the question of intermediates which, in his opinion, was at the root of the whole difficulty. We did not make enough of them in this country, and the whole energies of the colour makers must be directed towards meeting this difficulty. One of the blots on the chemical industry at the present time was the ridiculous confusion in nomenclature. A recent census taken in the United States showed that there were no less than 5000 different names of colours, whereas he believed the actual number of colours was not more than 800 or 1000.

Mr. W. L. OAKDEN asked if there were any dyes which after the war it would be impossible for this country to manufacture, and for which we should have to rely upon Germany.

Mr. C. BEDFORD said that the Germans had not only developed the technical chemical side of their industry, but also the technical business training. As an instance, he mentioned that in 1887 he patented a colour which had not been in existence three months before a representative of the Badische Anilin Company called upon him and asked for a licence. When it was refused, he was informed that so much capital would be brought against him that he would have to grant the licence. As a matter of fact, he had to grant a licence; and the Badische Company manufactured under it for several years. The colour had now, however, gone out of use.

Mr. J. LEESON expressed the hope that the colour industry would be more generous towards teaching institutions than in the past.

Mr. JAMES SWINBOURNE, F.R.S., hinted that it might be impossible even for the British Dyes Limited to face the future after the war, as, for purposes of trade exchange, it might be necessary to continue to import foreign colours.

Mr. WHITTAKER, in reply, held out no hope of reducing the number of names as suggested by Dr. Foster. As regards our dependence upon foreign raw materials, the only one in which Germany had a monopoly now was bromine. With regard to the question of technical institutions, he pointed to the fact that British Dyes Limited had made a grant of £5000 towards the Coal Tar Colour Department in the Huddersfield Technical College; so that, whatever had been the position in the past, there was not much to complain of at present.

The Middleham Gas and Coke Company has been registered with a capital of £1000 in £1 shares to take over the business carried on at Middleham (Yorks.). The registered offices are at Middlesbrough.

PAST, PRESENT, AND FUTURE OF THE GAS INDUSTRY.

Addressing recently a combined meeting of the Electro-Chemical and Illuminating Engineering Societies in New York, on the "Past, Present, and Future of the Gas Industry," Mr. Walter R. Addicks, who is first Vice-President of the Consolidated Gas Company of New York, said that at no time had the future of this important public service appeared more promising than at present. The most important requirement was uniform quality together with constant pressure, under all conditions of variation in rates of consumption and of temperature. Coal gas, as made by horizontal, sloping, or vertical retorts, or in coking ovens, from bituminous coal, was liable to vary in composition from day to day; but with blue water gas of 325 B.Th.U. per cubic foot, and oil gas of 1200 B.Th.U. available as equalizers, it was quite practicable to adhere closely to a uniform quality under all conditions of variation.

"Constant" pressure did not necessarily mean "uniform" pressure throughout the district of supply, but that the variation in any one locality should not cover too wide a range. The actual pressure at any one point was not an essential element. A heat unit standard of quality was of great service, as it admitted of distribution by means of high-pressure mains, and of affecting pressure equalization without material deterioration of the heat-producing qualities which was not possible under a candle power standard. High pressure was now in common use in suburban districts; a house governor being fixed on the service capable of reducing the initial pressure to any required degree, and carrying a safety escape pipe to prevent possible difficulties in the event of a derangement of the governor.

Among the inventions that had contributed to the present prosperous condition of the gas industry, he instanced the hydraulic seal, the steam engine and boiler, the exhauster, gasholder, and photometer, the gas cooking-range, internal combustion engine, and a large variety of industrial appliances, the fire-clay retort and highly refractory silicate materials suitable both for retorts and settings, laboratory apparatus readily operated by other than a skilled chemist, the calorimeter, and surface combustion. There were also epoch-making influences in the history of the industry, such as the introduction of cast-iron pipe in 1808, the Siemens generator furnace in 1862, the successful carburization of blue water gas by Professor Lowe at about the same period, the advent of the electric light in 1882 (which stimulated the manufacturers of gas toward all-round improvement), and of the incandescent mantle in 1887, the use of wrought-iron gas-mains inaugurated by Flannery in 1889, and of steel pipes with screwed or welded joints that would carry up to 100 lbs. per square inch pressure.

The introduction of the automobile in 1891 created a crisis in the carburetted water-gas industry, by withdrawing from the market the naphtha and gasolene that up to that date was the material used for enrichment. But the position was successfully met by the adoption of a lower gravity petroleum, which later became known as gas oil. The

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gradual adoption of the bye-product coke-oven resulted in the production of illuminating gas in large quantity as a bye-product. In the coke-oven, 5 to 12 tons of coal were heated for 18 to 24 hours; whereas in the retort, anything up to 1000 lbs. was heated for five to six hours. At present, only 40 to 60 per cent. of the coke-oven gas was utilized; the remainder being used for heating the ovens. This might, however, be effected by means of producers fed with coke—leaving the whole of the gas production available for other industrial uses. The success of the coke-oven turned upon a uniform demand for coke—the gas, tar, and ammonia being secondary products; while with the gas engineer the gas was usually the primary product. Some gas companies purchased the surplus gas from the coke-ovens for general distribution, but found it necessary to maintain a carburetted water gas set or other producing apparatus ready for use for equalizing variations in consumption, meeting sudden and unexpected increase in demand, or providing an adequate supply in the event of the coke-ovens partially or entirely ceasing production.

Continental Europe, Great Britain, Canada, and several States of the Union had adopted the calorimeter as a standard testing instrument in place of the photometer; and at the last meeting of the American Gas Institute, it was decided that the total heating value of a gas best represented its quality for general requirements, and several resolutions respecting details were also passed. It was therefore probable that future standards would include total heating value, absence of sulphuretted hydrogen, and limitations as to pressure variations at the consumer's meter, and that fixed sulphur, ammonia, and maximum and minimum pressure would be abandoned as obsolete.

A proper calorific standard would improve the strategic position of gas in the lighting field (no longer necessitating the presence in the gas of constituents that were likely to deposit carbon, soot mantles, and block pilot tubes), and would secure a permanent and uniform composition within a limit of 2 per cent. under all variations of atmospheric conditions. The mantle would always ensure a good lighting business. Great advance was being made in the adaptability of the incandescent burner to all sorts of conditions and pressures; and he instanced the high-pressure lighting at the World's Fair held at San Francisco in 1915. It was fortunate that the commercial conditions which made the heat unit value imperative, at the same time improved and simplified distribution, and that an increase of pressure, in all cases apart from the flat flame, improved the utilization efficiency.

Price of Gas at Newcastle-on-Tyne.—The Newcastle City Council have decided to write to the Gas Company asking for further information as to a proposal to increase the price of gas. This was after the Council had received a letter stating that, owing to the increased cost of coal, the price of gas would be raised 2d. per 1000 cubic feet. Mr. J. de Loriol said they had a rise of 2d. about fifteen months ago; and that was owing to the increased price of coal. This was regulated by the Government; and the Gas Company could not now be paying more for coal than they did a year ago.

ECONOMIC UTILIZATION OF COAL.

Second Howard Lecture at the Royal Society of Arts.

Professor Brame's second Howard lecture* before the Royal Society of Arts on the 4th inst., on "Coal and its Economic Utilization," did not contain a great deal of direct interest to the gas industry. On the lecture table was a very large collection of the specimens of bye-products from the distillation of coal in gas-works; these having been lent by Mr. Milne Watson, and arranged by Mr. F. W. Goodenough. The lecturer ran through the list of them with the aid of wall diagrams, and indicated the vast range of chemicals, explosives, and dyes now obtainable as bye-products of gas-works practice.

Dealing with a few individual cases in which economy in the use of coal can be effected, Professor Brame referred to the briquetting of coke breeze now being undertaken at the Smethwick Gas-Works by Mr. Vincent Hughes. He had, he said, been furnished with some samples of these briquettes; and although they were not very much used in domestic grates yet, nevertheless when burned with a small proportion of coal they gave a good fire. In enclosed stoves, however, for works boilers, greenhouse heating, &c., a ready market was obtained for this briquetted coke at 12s. 6d. a ton. Incidentally, it relieved the gas-works of about one-sixth of the tar; where if the coarser coke were briquetted in this way, it was estimated that about one-third of the tar would be used. Further plants were being erected at Coventry and Northampton. Similarly, the briquetting of small, and usually unsaleable, coal—particularly in South Wales—was providing a market for gas-works tar, large shipments of which were, before the war, sent to France and Belgium for the purpose of briquetting coal.

On the use of gas-works coke, as such, it was pointed out how power station engineers are paying close attention to this on account of the increasing cost of coal, and how, at the Deptford power station, a saving of 16 per cent. in fuel consumption had been obtained by using coke. The London Coke Committee had done a great deal in developing the use of coke. Steam buses and lorries now used coke, as did the colliers belonging to the South Metropolitan Gas Company.

Professor Brame welcomed the scheme of researeh outlined in Lord Crewe's reply last week to the deputation from the Board of Scientific Societies, and particularly the decision to commence with a survey of the coal measures of Great Britain. The arrangements had already been made for these researches at the Imperial College of Science.

* The first lecture was noticed in last week's "JOURNAL," p. 501.

Wages at Coleraine.—The Coleraine Urban District Council have granted a war bonus of 2s. 6d. per week to all employees whose wages do not exceed 20s., and 2s. a week to those who are paid more than this amount.

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The fire backs and heights overall are graded to coincide with the dimensions of Standard Grates. Note the appearance when in use. So like a bright coal fire, and it will pass all the "tests" for Efficiency and Ventilation.

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WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 11.

There is no appreciable alteration in the London tar products market. Pitch for export remains at 22s. net per ton at makers' works; while for home trade a better price is obtainable, seeing that pitch is now utilized for fuel in addition to carbonization purposes. The position of creosote appears to be very steady throughout the whole country: the material being largely required for fuel. There is a great likelihood therefore that the production will be mostly absorbed at home, and very little remain available for export. Solvent naphtha and other light products are unchanged.

Sulphate of ammonia secures good prices; the demand being keen. It is understood that makers ask £18 net per ton for 25 per cent. quality packed into buyers' bags at makers' works, for prompt delivery and, of course, for export.

Tar Products in the Provinces.

Dec. 11.

The markets for tar products remain the same. The price of pitch is unchanged, and very little business is heard of. Sales of solvent naphtha are reported at slightly lower prices. Creosote is very firm.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. to 22s. Pitch, East Coast, 16s. to 16s. 6d. per ton; West Coast—Manchester 15s. to 15s. 6d., Liverpool 16s. to 16s. 6d., Clyde 17s. to 18s. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6⅝d. Solvent naphtha, naked, North, 1s. 10d. to 1s. 11d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3d. to 3⅛d. Heavy oils, in bulk, North, 3⅛d. to 3⅜d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 70s. to 80s., bags included. Anthracene, "A" quality, 2¾d. to 3d. per unit; "B" quality, ¾d. to 1d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 9.

Although export licences have only been issued sparingly, the tone of the market has continued strong throughout the week, and higher prices have again been paid in all positions. The demand from abroad has been good; but the volume of actual business has been greatly curtailed by Government restrictions. The closing values for December are £18 5s. per ton f.o.b. Hull, £18 10s. f.o.b. Liverpool, and £18 12s. 6d. f.o.b. Leith; while for January-June delivery £18 17s. 6d. at the best ports is reported as having been paid.

Nitrate of Soda.

During the past week this market has advanced rapidly, and the spot quotations are now 19s. per cwt. for ordinary quality and 19s. 3d. for refined.

Sulphate of Ammonia.

From another source the quotations are given as follows: Outside London make, £17; Hull, £17 15s.; Leith, £18 to £18 2s. 6d.; Liverpool, £18; Middlesbrough, £18.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is little altered; but there is rather more coal being shipped, neutral steamers having come to hand rather quicker. There is still, however, a scarcity in tonnage, which affects prices unequally. Best steam coal is rather firmer. The price is from about 29s. 6d. to 30s. per ton f.o.b., while for second-class steams the current quotation is from about 26s. 6d. Steam smalls are from 17s. 6d. to 20s.; but the prices are a little varied by the possibilities of early shipment. In the gas coal trade, the demand is good; but prices are variable. Best Durham gas coals are from 24s. 6d. to 26s. per ton f.o.b.; for second-class qualities the current quotation is from 18s. 6d. to 19s. 6d.; and for "Wear" specials 25s. to 27s. 6d. f.o.b. is named. The home demand for gas coal is now at its heaviest; but the foreign requirements are impeded in delivery. Contracts seem now to be fairly met. A few small contracts for gas coal for next year seem in the market; but it is probable that they will be settled at limitation prices. The larger sales are yet to be arranged. Good gas coke is from 34s. to 35s. per ton, according to the place of shipment and the quantity for the cargo. The latest coke freight is for 1500 tons, Tyne to Rouen, at 46s. per ton; while the freight on gas coal Tyne to London is 15s.

Pursuant to their Provisional Orders 1898 and 1911, the Cannock, Hednesford, and District Gas Company, Limited, are making a further issue by tender of 5000 £1 shares, which will rank for dividends and in other respects as from the 1st prox. with already issued shares. The last day for the receipt of tenders is the 14th inst. For particulars as to conditions, &c., see advertisement appearing in this issue.

The Hornsey Town Council have received a communication from the Hackney Borough Council asking for a contribution of £100 towards the costs of defending the action being brought by the Gas Light and Coke Company in respect of a reduced charge made for electric energy supplied for lighting purposes to customers who are power consumers—it being alleged the charge constitutes an undue preference. The matter was referred to a Committee.

THE "ZENITH" GAS HEATED BOILER.

is a COMBINED HEATER and STORAGE TANK complete with AUTOMATIC GAS VALVE (Thermostat).

The "Zenith."

Unequalled for providing constant supplies of Hot Water by day or night.

Especially valuable for use in Military Hospitals and temporary buildings devoted to the care of the sick and wounded.

Made in three sizes:—10, 20, and 40 gallons.

Full Particulars and Illustrated List on application to

ARDEN HILL & CO.,
ACME WORKS,
BIRMINGHAM.

Extension of Carbonizing Plant at Stockport.—The Chairman of the Stockport Corporation Gas Committee (Mr. Jacob Winter, J.P.) and seven other members have been constituted the Works Sub-Committee to consider the question of an extension of the carbonizing plant and to report thereon to their colleagues.

Working at a Loss at Carnarvon.—The unfortunate announcement had to be made at a meeting of the Carnarvon Town Council last week that the gas-works are now working at a loss, with the probability of having to face a heavy deficit at the end of the year, owing to the advance in the price of coal. On the recommendation of the Gas Committee, it was resolved to increase the price of gas to all consumers 3d. per 1000 cubic feet.

A Flueless Gas-Stove Tragedy.—Mr. George Brown, a Walsall tradesman, and his wife had placed near the foot of the bed in their room a gas-stove without a flue to carry away the products of combustion. They lived alone; and one morning when entrance to the house was forced, the husband was found dead in the room, and Mrs. Brown unconscious. The windows of the room were closed, thus reducing the possible ventilation to a minimum.

Mexborough Water-Works Purchase Arbitration Award.—Mr. A. J. Ram, K.C., has issued his award in the arbitration between the Mexborough Urban Council and the Mexborough Water Company as to the price to be paid by the Council for the undertaking of the Company, under compulsory purchase powers. The price is fixed at £19,980, if the money is paid at the date specified in the Council's Act (the end of the quarter following that in which the award is taken up), and the price is to be £22,060 if the money is not paid until a year after the conclusion of the war.

Leeds and the Sulphate of Ammonia Association.—On the minutes of the Gas Committee coming up for confirmation by the Leeds City Council, Mr. Noon moved the deletion of a resolution pledging the Committee to become subscribers for one year to the Sulphate of Ammonia Association. But, on the explanation being given that the cost of approximately £100 was well worth while, seeing that the net value of the material dealt with was about £25,000, he withdrew his motion. It was pointed out to him that the other leading corporations were members of the Association.

A "Patent Gas-Heater" Fatality.—It was stated during an inquest at the Bradford Town Hall, on the bodies of Alice Hardy (64) and Ann Barraclough (57), of Buttershaw, that both women, one of whom had been ill for some time, went to bed as usual on Monday night of last week. During the day, a patent gas-heater had been fastened to the gas-bracket in the bedroom, and was left burning during the night. The bedroom door was closed; and there was a screen in front of the fire-place. The room was a very small one. The next morning a relative found both women dead in bed. Medical evidence showed that death was the result of the inhalation of "exhaust gas-fumes." A verdict of "Accidental death" was returned.

Decreased Sales of Gas at Stockport.—At the last meeting of the Stockport Gas Committee, it was reported that the gas sold for the quarter ended Sept. 30 (inclusive of public lamps) was 143 million cubic feet, as compared with 169 million feet in the corresponding period of last year, a decrease of 26 millions, or 15·41 per cent. The gas-rentals for the same periods amounted to £21,684 and £26,230 respectively, a decrease of 17·32 per cent.

Fermoy Gas Supply.—At a meeting of the Fermoy Urban District Council, complaint was made that undue delay had taken place in renewing the gas supply on the subsidence of the floods caused by recent heavy rains. One member said the Gas Company had only the ordinary staff to cope with the work; and there was a general feeling that they ought to have secured extra help. The Clerk was directed to send a protest to the Company, and to point out the great inconvenience that had been caused to traders.

Settlement of Burnley Water-Works Litigation.—It is announced that two actions in the High Court, in which the Burnley Corporation were concerned, have been settled. Both arose out of the new water undertaking at Hurstwood, and the failure of the first Contractors for the reservoir, Messrs. Macdonald, Deakin, and Jones. There was a large claim by the Trustee in the Contractors' estate against the Corporation for retention money, &c. The other action was by the Corporation against the Liverpool, London, and Globe Insurance Company, with reference to their bond of £15,000 for the fulfilment of the original contract.

Increase in Price at Filey.—In view of the great increase in cost of production, the Filey Gas Committee last week recommended the Council to advance the price of gas from 3s. 8d. to 4s. 4d. per 1000 cubic feet, to take effect from Jan. 1. They made this recommendation very reluctantly; but it had been found that the cost of production and distribution, after deducting proceeds from residuals, was 2s. 7d., and loan charges amounted annually to 1s. 9d. per 1000 feet. It was expected that the cost of production would be higher in the coming year; and the tar produced was not only not fetching a better price, but there was some difficulty in getting rid of it.

Gas-Fire Enterprise at Stockport and Marple.—The Marple Gas Committee have decided to hire-out gas-fires to consumers. The enterprise should prove successful, for the district is fast becoming one of the most popular residential areas round Manchester. Stockport, a few miles away, has encouraged gas-fire consumers for several years; and that success attends their efforts is shown by the last report of the monthly meeting of the Gas Committee, wherein it is reported that a contract has been let to Messrs. Fletcher, Russell, and Co., of Warrington, for 250 fires—their tender being the lowest of eight. During the past month, no fewer than 126 gas-fires were hired-out in the district, in addition to 106 gas-cookers. A Special Sub-Committee has been appointed to formulate new schemes for advertising the uses of gas, and to report to the Gas Committee.

There must be Exceptional Merit!

THE "ADAM."
"Period" Series.

℄ "Design is not the idle offspring of fancy; it is the studied result of accumulative observation and delightful habit."
—*RUSKIN.*

The beautiful outline and general artistic appearance of Richmond's "Period" Gasfires introduced a note of High Art into the Gas-fire Industry.

The confidence placed in these Silent Gasfires throughout the Country, and the heavy demand experienced earlier in the season, continues to be felt.

THE RICHMOND
GAS STOVE & METER CO., Ltd.,
WARRINGTON :: and :: LONDON.

Going Back at Wells.—When presenting to the Wells (Somerset) City Council a report from the Lighting Committee to the effect that twelve lamp standards, with lanterns and oil-lamps complete, had been purchased, Alderman Norton explained that the reason for reverting to this "antiquated method" of lighting was that the Committee demurred to the Gas Company's suggestion for the payment of £181 a year for the maintenance and interest on capital for the existing gas-standards. He added that the Company had refused to accept what he considered a generous offer. The report was adopted.

Irish Gas Charges.—The Bangor (co. Down) Urban Council last week adopted a recommendation for an increase in the price of gas of 5d. per 1000 cubic feet, making it 4s. 2d. The Lisburn Urban Council decided to withdraw all rebates and discounts in connection with gas accounts, from Jan. 1, and to adopt a scale of meter-rents. At a meeting of the Omagh Urban Council, a letter was read from the Lisburn Council asking if the two Councils could join in obtaining a Provisional Order authorizing an increased price of gas, as at present gas could not be supplied at the rate fixed by the Act, except at a great loss. It was intimated that, in existing circumstances. the Omagh Gas-Works were being worked at a loss; and it was decided to take legal opinion with regard to the Lisburn proposal.

Price of Gas at Pontefract.—The price of gas at Pontefract was advanced last week from 3s. 7d. to 4s. per 1000 cubic feet. The charge was 2s. 11d. twelve months ago.

Precautions for "T.N.T." Workers.—During a Coroner's inquiry near London, regarding the death from "T.N.T." poisoning of a girl 16 years of age, who worked in an explosive factory, it was stated that no one under 18 or over 45 was engaged; but the girl said she was 18. The Government Contractor said a new type of machinery had been installed, so that "T.N.T." would be very little handled. The work would be carried out under glass screens, which would exclude the dust; and electric fans would draw the dust-laden air out of the building. Under this new process he did not think it would be possible to get any disease at all. Dr. T. M. Legge (Medical Inspector of Factories) said those under 18 were susceptible to the effects of "T.N.T." powder; and the Ministry of Munitions was taking steps to prevent their employment. At this factory no fault could be found with the arrangements. The Jury, in returning a verdict of "Death from 'T.N.T,' poisoning from misadventure," suggested that girls seeking employment at explosive factories should produce their birth certificates. This Dr. Legge said was already required, when there was any doubt.

STOCK MARKET REPORT.

It almost goes without saying that business last week on the Stock Exchange was wholly saturated and dominated by the dramatic downfall of what will probably be indexed in the future as the "Wait-and-See" Government. And here it may at once be noted that, in regard to the "business" of the week, there was as little of it as is practically possible, short of absolute stagnation. Buyers and sellers alike stood aloof, watching with eager amazement each rapidly successive phase in this wonderful revolution. The Stock Exchange welcomed it enthusiastically, though Mr. C. Clarke did not head a musical demonstration; and, indeed, City business circles in general were similarly minded. Great hopes are entertained with reference to the new Government's financial policy, as meaning death to the fantastic devices of political mandarins who scorn to consult professional experts.

Taking the week, such as it was, a favourable indication was afforded by the attitude of the War Loan, which hardened as the days went on, and Colonial issues were in some demand. Home Rails had not much chance of making a recovery; departmental control, labour contingencies, and other bogeys haunting them. American and Canadian lines oscillated irregularly. Argentines had a poor week, though the last prices were a bit better.

The Foreign Market was better on the whole, French, Chinese, and Japanese issues were all conspicuous in the van; but Russians were rather dull. There were points of interest in the Miscellaneous group. In Shipping lines, something like a slump set in, actuated by anticipations of Government control and an end to the reign of high freights. Another chastening influence of the like authority was perceptible among Welsh collieries.

Business in the Gas Market was almost as a matter of course very quiet indeed in such a week of general cautious restraint, and such few bargains as were struck were probably the fruit of circumstances compelling realization. The tendency was naturally easier. A noteworthy incident, the effect of which may be felt beyond its point of origin, was the prohibition placed by the Indian Government against the export of the better class coal. In the Money Market all demands were readily met by the supply.

Bargains done for cash during the week were as follows: On Monday, Brentford "A" 86½, British 34½, Gas Light ordinary 71, 71⅛, ditto maximum 56½, 56¾, 57, ditto debenture 59, Primitiva preference 62s. 6d., 63s. 9d. On Tuesday, Brentford "A" 86, Gas Light ordinary 70, 70¼, 70⅜, 70⅝, 71. On Wedesday, Brighton and Hove "A" 115, Commercial 4 per cent. 73, 73½, ditto debenture 53, Gas Light ordinary 69⅝, 69¾, 70, 70¼, Imperial Continental 74, Newcastle 79½, Primitiva preference 61s. 3d., 62s. 6d., 63s. 9d., South Metropolitan 83¼. On Thursday' Gas Light debenture 58, Primitiva 40s., 40s. 7½d., South Metropolitan 82. On Friday, Gas Light ordinary 69½, 69¾, 70, 70¼, 70½, ditto preference 70, ditto debenture 58, Imperial Continental 73, South Metropolitan 82, 83. On Saturday, Gas Light ordinary 69½, 70, 70½, South Metropolitan 82.

The Bank rate is 6 per cent.—as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	65—70	..
1,551,868	,,	April 8	2½	5⅛%	Alliance & Dublin Ord.	59—64	62—64	..
374,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	60—65	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅛—6⅜	4¼—5⅜	..
50,000	10	Feb. 26	16	15/-	Bourne- 10 p.c.	29—30	25—27	..
388,110	10	,,	7	7/-	mouth Gas B 7 p.c.	15—15½	11—11½	..
115,000	10	,,	6	6/-	and Water Pref. 6 p.c.	13½—14	9½—10½	..
159,740	—	,,	—	4%	4 p.c. Deb.	..	73—75	..
992,045	Stk.	Feb. 26	†14	55/-	Brentford A Consold.	261—266	85—87	86—86½
734,920	,,	,,	†11	53/9	Do. B New	204—209	83—85	..
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	85—90	..
221,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—98	69—71	..
217,880	Stk.	Feb. 26	11	10½%	Brighton & Hove Orig.	208—213	160—165	..
244,200	,,	,,	8	7¼%	Do. A Ord. Stk.	154—159	115—120	115
580,000	20	Mar. 26	19½	22/6	British	44—45	34—35	34½
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	68—70	..
245,771	Stk.	June 26	4	4%	Buenos Ayres 4 p.c. Deb.	85—87	60—65	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	1½—1⅝	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5*	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	Stk.	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	82—83	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	72—74	73—73½
560,000	,,	,,	5⅓	46/8	Do. 3½ p.c. do.	103—105	68—70	..
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	53—55	53
800 000	Stk.	,,	4	—	Continental Union, Ltd.	76—79	36—38	..
200 000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	57—59	..
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	175—185	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5⅔%	Derby Con. Stk.	128—125	100—105	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	7/6	European, Ltd.	17½—18	11½—12½	..
16,318,430	Stk.	Feb. 10	4/17/4	42/-	Gas 4 p.c. Ord.	98—102	69—71	69½—71⅝
2,600,000	,,	,,	3½	3½%	Light 3½ p.c. max.	76—79	55—58	56½—57
4,062,235	,,	,,	4	4%	and 4 p.c. Con. Pref.	96—99	69—71	70
4,674,850	,,	June 11	3	3%	Coke 3 p.c. Con. Deb.	72½—74½	58—60	58—59
130,000	,,	,,	10	10%	10 p.c. Bonds	..	..	..
258,740	Stk.	Mar. 12	5	4⅞%	Hastings & St. L. 5 p.c.	87—89	78—83	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16¼—16½	8—9	..
86,600	—	—	—	9%	Hornsey 7 p.c.	..	125—135	..
181,000	Stk.	Mar. 12	7⅞	7½%	Ilford A and C	151—154	112—117	..
65,780	,,	,,	6⅜	5⅞%	Do. B	115—119	103—108	..
66,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	73—76	..
4,940,000	Stk.	May 14	9	4½%	Imperial Continental	150—160	72-77	73—74
1,235,000	Stk.	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,342	Stk.	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	87—92	..
2,498,905	Stk.	Feb. 26	10	5%	Liverpool 5 p.c. Ord. A	211—213	86—87	..
					B	146—148		
206,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	74—76	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	4—4½	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	89—93	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8½—9*	..
1,875,892	Stk.	July 29	4½	4½%	Newc'tle&G'tesh'd Con.	98½—99½	79—80	79½
529,705	Stk.	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	75—77	..
55,940	10	Feb. 26	7/14/0	7/8⅝	North Middlesex 7 p.c.	14—15	10½—11½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106*	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	128—131	95—100	..
100,000	50	,,	12	11%	Do. C	118—121	88—93	..
52,000	50	,,	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	2 2½	40/—40/7½
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅜—5	3 - 3½	61/3—63/9
521,600	100	June 2	4	4%	,, 4 p.c. Deb.	91—98	78—80*	..
—	—	—	—	4%	,, ,, ,, 1911	..	..	..
846,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	63—68	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	8—8½	..
125,000	50	July 1	5	5%	5 p.c. Deb.	47—49	43—45	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	238—234	188—192	..
209,984	,,	,,	10	10%	Do. B	232—234	188—192	..
523,500	,,	,,	10	10%	Do. C	230—232	188—190	..
90,000	10	May 28	9	6/-	South African	10½—11½	..	..
6,609,896	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	82—84	82—83½
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	59—61	..
224,830	Stk.	Feb. 26	8½	8%	South Shields Con. Stk.	157—159	145—147	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	80—82	..
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	79—81	..
135,000	—	—	—	48/4	Do. West Kent.	..	..	..
187,558	,,	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	90—92	..
647,740	Stk.	May 14	5	5%	Southampton Ord.	99—102	88—93	..
120,000	Stk.	Feb. 12	7½	7½%	Tottenham A 5 p.c.	185—188	120—123	..
782,276	,,	,,	6	5⅝%	District B 3½ p.c.	115—117	90—92	..
181,255	,,	June 26	4	4%	4 p.c. Deb.	87—89	67—69	..
182,880	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
286,476	Stk.	Mar. 12	5	5%	Tynemouth, 5 p.c. max.	108½—109½	91—92	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	117—122	..
255,636	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	101—108	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	88—93	..
352,000	,,	,,	6½	57/6	Wimbledon 5 p.c.	117—122	90—95	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c.	121—126	98—103	..
88,416	,,	June 26	8	8%	8 p.c. Deb. Stk.	66—69	53—56	..

* Ex. div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

R. & J. DEMPSTER LTD. 54 & 2296 Manchester
PAN ASH. "DUKE" BREEZE & COAL WASHER.
NOTA NOE
HEAD, WRIGHTSON, & CO., LD.
SOLE MAKERS OF THE